RIG™

Remote Imaging Group

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CHAIRMAN'S REPORT

FRANK BELL

Our main event of the year has just taken place. The annual conference and exhibition this year was held on the 27th. April 1996 at West Cheshire College and judging by the response of delegates it was a very successful occasion. A fuller report is elsewhere in the journal so I will not deal with any details except to offer my thanks to those people who put in so much hard work into organising the day. Our hosts at West Cheshire College could not have been more supportive, in particular I would like to thank Rob Bale, both for his initiative in offering the college as a venue and then for all the organising he did over a period of months leading up to the day of the conference. Thanks must also go to all the committee for their work both beforehand and on the day itself.

The AGM which followed the conference was very well attended. Minutes of the meeting and other details will be reported in due course. In my report to the meeting I said that I thought RIG have had a very successful year as measured by a number of standards. Membership continues to increase, the club projects appear to be very popular, the Journal goes from strength to strength, the shareware and image library continue to be well used. This success is attributable in the main to the hard work put in by the committee. However, other non-committee members also offer regular technical support to the group. In this hi.tec, fast moving hobby of ours we needed all the expert help we can get; sincere thanks to all concerned.

It is good to have new committee members so welcome to John Boyer. We certainly value his technical skills relating to the Internet. It is sad that we will be missing Henry Neale and Michael Gill. Due to pressure of work Michael decided he could not continue as a regular committee member. Henry did not stand for re-election. At the AGM we did discuss Henry's contributions to RIG, not only as a founding member but all his subsequent hard work for the Group over the years. He was given a unanimous vote of thanks. As I write, Henry is still running a BBS and I personally hope he will continue with his regular electronic contact with members. I would very much like to see three more people on the committee. We need a treasurer, somebody who will to look after our rally interests and somebody with a legal background would be a great asset. Don't be shy; get in touch with an existing committee member: RIG needs YOU.

With a number of rallies coming up soon I expect we will remain busy on your behalf promoting the value of RIG membership. And a final thought; I expect we will have a conference again next year; where shall it be held? The Bristol area would give a nice regional balance to our venues. Any offers? ⊕

FROM THE EDITOR'S DESK

PETER WAKELIN

We aim to get the Journal out at the beginning of the month but this issue will be a little late. When the deadline for copy passed, I had sufficient for only about 20 pages so held things up to include a report on the Chester conference and the AGM. At the latter, and also on the RIG BBS, I pleaded for more articles to print. I am grateful to those who responded; it has enabled Mark and me to put together a good-sized issue covering quite a range of topics.

This page is usually the last to be prepared before going to press and Frank Bell tells me that, since writing Chairman's Report, he has had considerable feed-back from delegates saying how much they enjoyed the conference and he thanks them for their remarks. My only regret was the shortage of time to natter with delegates but this is an inevitable consequence of a one-day conference. Perhaps the venue and time of the pre-conference gathering at the "King's Head" the previous evening should have been better publicised.

One thing I learned at Chester, which I found surprising, was the number of members who have modems; about 80% of those present at the AGM said they had them and about half of those had Internet facilities. A statistician would balk at my extrapolating the poll of such a small sample to the entire membership but it is quite clear that Internet connectivity is growing rapidly amongst our members. Is this a good thing? Will you stop receiving images directly from satellites if you can get them down a telephone line? If so, and Heaven forbid, would you find you no longer need RIG? With such rapid advances in electronics technology it is impossible to predict what the situation will be in 10 or 20 years but, in the shorter term, my personal view is that RIG and the Internet are complementary. I got the image of the Aral Sea, which appears in this issue, via the Internet within a couple of hours of NOAA 14 taking it yet I will still get up at 3.00 am to receive directly a stored image from Sich 1 at 5 degrees elevation! From the huge demand for the RIG*sat* receiver and interface kits it is apparent that constructing the hardware is, to many members, the most satisfying part of the hobby. To these people, Internet will probably have little effect. What are your views on this topic? Please write and let me know.

In this issue John Tellick writes about the potentially devastating conflict between pager transmitters and the new NOAA/EUMETSAT polar-orbiter frequency of 137.9125MHz. Even with a directional antenna I now have serious problems with Meteor signals on 137.85MHz when near the horizon so 137.9125MHz will be quite impossible. Unfortunately the use of pagers is not just just a yuppy fad that will

have passed by the time the new generation of satellites is operational. It seems there really are people who consider themselves so indispensable they need to be constantly on call. Some don't travel on underground trains for fear of missing a message. Higher frequency signals do not penetrate buildings so well so it is unlikely that pagers will move from the band in the forseeable future. Whether a solution will be found remains to be seen but there are only five years in which to resolve it.

REPORT OF THE 1996 RIG AGM
John Tellick

The chairman, Frank Bell, welcomed the 73 members who attended the AGM which was held at the West Cheshire College, Chester, on 27 April.

Apologies for absence were received from Henry Neale, Michael Gill and John Boyer.

Minutes of the 1995 AGM were agreed and signed by the Chairman.

Matters arising from the 1995 Minutes: None.

Chairman's Report

Frank Bell reported a successful year for RIG - a year of progress. It is gratifying to see the membership continue to increase. The ever-expanding image and shareware libraries are well supported by members and well managed by Peter Wakelin and Les Hamilton respectively. The committee is sensitive to the needs for club projects and we have seen the amazing success of the RIG*sat* RX1 receiver and the RX1A 5-channel add-on this year and now the IF1 interface board. There does seem to be enthusiasm for self-build projects and we intend to service this need through Ray Godden.

We have attended six rallies in the last year and will continue to attend as many as possible, subject to volunteers being available. We maintain the policy of not selling large quantities of equipment at rallies owing to the logistical problems. The Journal continues to be a great success under the Editor, Peter Wakelin and Make-up Editor, Mark Pepper. Representations to official bodies (one of the reasons for RIG's existence) has again been undertaken by John Tellick in order to represent members' interests. Frank added that the success of these various activities had rested, to a large degree, with the committee and he thanked the committee members for their hard work and commitment.

Frank reported that the change of Chairman had been a painful process. Although

not seeking the role, he was elected Chairman after the 1995 AGM. Henry continued to play an active role on the committee until January 1996 when he informed the committee that he would attend no further meetings and would not seek re-election. Frank said he found the situation very disappointing, not least because of Henry's technical knowledge and rapport with members.

In concluding, Frank said RIG needed new committee members. In particular, a new treasurer is needed and also, someone with knowledge of legal matters would be an asset to the Group.

Secretary's Report

John Tellick briefly described his tasks as Secretary, then went on to talk about his latest 'project' of making representations to numerous authorities about the effect of the proposed frequency changes for APT transmissions from the next-generation of satellites. One of the new frequencies is very close to a pager frequency widely used in the UK. John also reported that the WMO had requested RIG membership information to update their satellite users' database.

Treasurer's Report

Although Mark Clarke was unable to provide a copy of audited accounts in time for the meeting, he nevertheless reported another successful year. The value of sales, though not the number, has decreased over the previous year as a result of the Group's policy of making low-cost kits available as an alternative to commercially made equipment.

Mark reported that due to other commitments he would have to relinquish the post of treasurer but wished to remain on the committee. If a replacement could not be found, then the Group would need to pay for professional help.

Membership Secretary's Report

Ray Godden reported an increase of about 200 members to 2140 in 1995. He added that, at the present time, there are 125 more members than at the same time last year and therefore predicted a further significant increase in the 1996 total. Reminders would shortly be sent to the 475 who had not yet renewed for the current year. Ray then reported on his analysis of the comments made on the membership renewal forms.

Editor's Report

Peter Wakelin reported that around 400 pages were produced during 1995 and he

thanked the contributors, several of whom were in the audience. He reported on the change to contract mailing which reduced his workload and also saved not less than £700 per year in postal charges.

As always, Peter pleaded for more articles for the Journal; RIG 45 is looking very thin at the present time. He suggested a series of images of the past winter's unusually large quantity of ice in the Baltic area and asked those present to check their archives for suitable material.

Make-up Editor's Report

Mark Pepper had nothing to add to the Editor's report but gave a brief description of the new RIG BBS. A poll of the audience showed that about 80% had modems and half of those had an Internet connection.

Nominations for and Election of the 1996 Committee

The Chairman invited members with 'special' talents to offer their services but nobody sought election. Michael Gill and Henry Neale did not seek re-election and John Boyer had recently been co-opted onto the committee. Ted Avery proposed re-election of the present committee en bloc and this was seconded by Brian Boon.

Before AOB, John Tellick wished to formally propose a vote of thanks to Henry Neale for all his work and service to RIG over 11 years. This was seconded by Frank Bell with full agreement from the floor. A member then suggested Henry be made a life member and this will be discussed by the committee.

Any other Business

A member suggested we seek support from other groups worldwide in light of the NOAA/METOP and UK pager frequency clash. As two of our US members are attending the NOAA Symposium in June, they could be asked to raise the matter there.

Another member asked if up-to-date news on satellite launches etc. could me made available on packet radio for those members without modems. Mark Clarke responded by saying that pressure of work had prevented him from maintaining this service but Brian Boon offered to take on the task.

A member then said he wished to thank the committee for all their hard work and for organising the conference. This was greeted with a round of applause. The Chairman thanked the floor for that and said the conference organisation had had its problems due to the distance. He then thanked Rob Bale for offering the facilities at the West Cheshire College. 🌐

THE 1996 RIG CONFERENCE AT CHESTER

Ted Avery

I think I'll go to this conference at Chester in April. Is that OK? I asked. Of course it is; you can drop me and the grandchildren off and we'll spend the day in Chester. Done, I said. One doesn't argue with logic like that. Anyway, as a result of this conversation I found myself at 9.30 on a fair spring day at the West Cheshire College where the RIG Conference was being held.

After signing in and being given my first free cup of coffee of the day, there was a short time to view the display area.

The Exhibition Area

Here was the RIG stand with Mark Pepper showing his new receiver/JVFAX system using the RIG RX1, RX1A and the new IF1 interface. He was receiving live Meteosat pictures all day, as was evident during the lectures, when the familiar 'pinging' could be heard. Mark's system was built very neatly in a small diecast box and gave a very professional 'image' (pun intended). Also on the RIG stand was John Tellick giving a display using a DARTCOM system.

Sam Elsdon was giving an animation demonstration using a PROsat system together with his switchable filter contrast enhancer and integrated Meteosat RX1 receiver. Sam also demonstrated his home-brewed rotator-elevator using two separate rotators. The systems in this area were being fed from a loop Yagi set up on the grass outside the main building.

Next in line in the display area was Timestep demonstrating their various systems. They were offering some price reductions on a complete HRPT system.

Parity Computers were demonstrating their multimedia computer systems. They use some pretty smart cabinets for their system boxes and the monitors had a drop-down flap giving access to an impressive console for setting up the monitor using the latest microprocessor system. I have a 15" monitor that uses this very slick microprocessor control and it is excellent. Next time you buy a monitor look for this facility.

A second RIG table in this area was doing a brisk trade in back-issues of the Journal and also the double Meteosat CD entitled Europe's Four Seasons. I'd been looking forward to getting my hands on this CD for weeks, so it was straight in with the shekels before they were all gone.

Spread liberally around the exhibition area were numerous very interesting posters

on imaging. The last group of people in this area (but not the least) were the ladies of the catering department from the college dispensing free tea and coffee. This was an organisational touch that helped to make the day go very well.

The main lecture hall was next to the exhibition area and in here there were more displays. RIG had another stand with a METEOSAT system using JVFAX and a RX1 with a DARTCOM downconvertor with a one-metre dish outside the building at ground level.

The second display in the hall was by Timestep but more about this later.

The Technology Centre

Having been involved with computers and education since 1967, I was very impressed with the West Cheshire College's Technology Centre. Demonstrations of weather satellite image reception were performed by college staff. There were CD systems available in the library area and also an Internet demonstration.

The college has the Meterological Information Self Briefing Terminal (MIST). This system provides the college with a direct link to the main computer terminal at the Meteorological Office at Bracknell, giving access to a wealth of up-to-the-minute data from Europe and the North Atlantic. This information can be used to complement areas in the curriculum where the understanding of weather processes play an important part.

The data available include:

Synoptic charts for up to 5 days ahead with animation
Plotted weather station reports
Rainfall radar images
Lightning/thunderstorm location data
Wave height and tidal surge predictions
Satellite images of Europe with the facility to superimpose rainfall radar data
Temperature profile maps of Europe

The centre also runs a DARTCOM system for live image reception and a weather monitoring station using a microprocessor-controlled data gathering system, allowing gathering and archiving of real-time data. Parameters measured include temperature, humidity, wind speed and direction and rainfall.

The Conference and Speakers

The chairman, Frank Bell, briefly welcomed everyone to the conference with a few

words about the order of the day before introducing the first speaker.

Earth Observation Present and Future
Keith Hilton, West Cheshire College

Keith started by explaining his early involvement in satellite imaging covering the use of data for geographical needs rather than meteorological. He used slides to demonstrate multispectral techniques for highlighting changes in landscape. By taking successive images and using colour enhancing techniques changes can be shown over short and long periods of time.

Examples of the use of this technique being crop recognition, to determine what farmers are growing and forest depletion. Multitemporal imaging can readily determine high and low tide marks, data for which would take an army of men and vehicles to gather. Images of Morecambe Bay demonstrated thie to very good effect. All the early imaging satellites used visible and near infrared techniques but the future lies in the exciting radar imaging technology. Images were shown from the Canadian Radarsat. Of particular interest to me was the radar image of forest fires in British Columbia as I had just completed a film of fire fighting in B.C.

APT Satellite Reception from 101 deg E 79 deg N
Martin Harris, Oxford Scientific

Pack a laptop computer, a crossed dipole antenna and a receiver and go north. Now there's a challenge but it is precisely what Martin Harris did. He went to the Bolshevik Island/Boris Vilkitski Strait area of Severnaya Zemlya to monitor ice conditions. Martin had the full co-operation of the Russian authorities in his mission and they laid on an ancient fixed-wing aircraft and a helicopter, both of which Martin was happy with as they came complete with a mechanic and a toolbag. Very reassuring! Fuel was obtained by a bartering process with the pilot landing at whichever airports offered the cheapest fuel.

The area that Martin was monitoring is designated a national park. His base was at a defunct cold-war forward station which was no longer forward and extremely tumbledown. The antennas were erected by the local fire service using a turntable ladder, and it did not deter them from returning to help in retrieving the antennas a few days later when Martin moved on.

The slides of satellite images shown were photographed from the computer's screen and showed the ice and sea as imaged by the NOAA satellites. Being at such a high latitude there are far more passes to play with each day. The main finding from the exercise was that global warming is a reality and is here now. The survey was looking at ways of getting shipping through the ice from N.W. to the N.E.

The Russian have 3 nuclear-powered ice breakers and they have not been as busy as usual. To illustrate the fact Martin recounted how the Duke of Edinburgh, on a visit to the area, requested an ice-breaker. It simply followed the Duke's ship through the open seas- an area normally covered in dense ice.

Measuring Changing Sea Levels and Wave Heights from Space
Philip Woodworth, Bidstone Observatory

Philip started by explaining that the instrument used for tide height gauging was invented by Napoleon and is still in use today around the world. It is a simple mechanism using ropes and pulleys and a clockwork motor to drive the recording drum.

The precise recording of sea levels and wave heights is now achieved using the satellite TOPEX Poseidon which orbits at a height of 1300km. The flight path is such that the satellite passes over the same place every 10 days. A period of time close enough to measure changes to an accuracy of 2cm.

A useful feature of radar backscatter is used to measure windspeed. Radar pulses are returned at varying power levels depending on the wave type. A smooth wave or sea will return more power. The ripples on the surface of the waves will dissipate more of the energy pulse and reflect less back to the satellite. Wind speed is a function of this returning energy pulse. Similarly, wave height is measurable by the time the pulse takes to return. Peaks and troughs show as varying time intervals.

To achieve this accuracy the height of the satellite must be constantly monitored. This is done using a network of radar and laser stations around the world. These can check the accuracy of the satellite height to 2cm. Laser ranging does, of course, require clear skies.

Live Demonstration of NOAA14 HRPT
Dave Cawley, Timestep

The lunch break was timed to end just before a good pass of NOAA 14. Dave gave a description of the new helical feed on the dish which was mounted on an azimuth/elevation rotator outside the building. Timestep have found that the helical feed system they have developed is perfectly adequate and this proved to be so when the satellite appeared over the horizon. HRPT is transmitted at 1.6GHz and therefore tracking is necessary. The setup being used for the demonstration had a separate computer controlling the AZ/EL rotator though it is perfectly possible to track the satellite by hand using the control switches on the rotator's control box.

Having only seen Meteosat and APT reception live it was surprising to see the picture looking extremely distorted upon reception. Once the pass had finished, the

PROsat software did some pretty amazing transforms and a well-proportioned picture appeared on the screen.

Dave demonstrated all the five channels of data received and also how, by moving the pointer onto a particular point on a picture the temperature was displayed in the top corner of the screen. This particular pass produced well under the maximum 80Mb of data due to the satellite being obstructed by trees and buildings. The detail available is quite impressive. Now where did Kath hide that cheque book?

The Millennium Satellite
Frank Bell

I feel that there will be a fuller report on this project elsewhere in the journal so I'll only briefly mention that Frank gave us the hot-off-the-press news that £3.3 million of the expected £6.6 million price tag for this exciting project has been promised by the Millennium fund. Numerous manufacturers have offered their support. This satellite is being aimed at education and home users alike and will not use frequencies in the Amateur bands or the normal 137-138MHz band. The aim is to make this satellite's data available to anyone as simply as possible without expensive equipment.

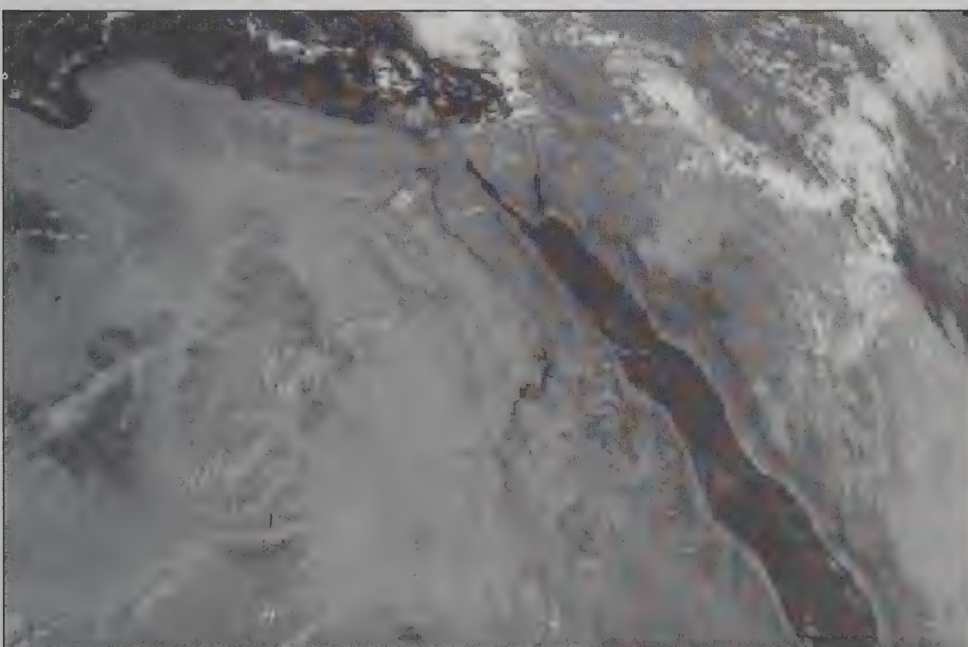
Plenum

There followed a short session where the floor was invited to question the technical committee on any subject they wished. There was some discussion about the proposed frequencies for the next generation of NOAA polar-orbiting satellites which will transmit low rate digital data. The major concern is the proposed frequency at 137.9125MHz which, with the proposed 150kHz bandwidth of the receiver I/F, will put the dreaded pagers into band and make the satellite useless to many UK users. Representation has already been made to various authorities on this point. Those of us on the NOAA mailing list have received a questionnaire and were able to express our thoughts on the new system. We must wait and see.

In conclusion, this was the first RIG conference I had attended. It won't be my last. It was not overly technical and the speakers kept their talks to a comprehensible level. The people manning the displays were erudite with their explanations. As a purely APT user I learned a lot during this conference. I think there must be more out there that I can have a go at somehow. Thank you to all concerned. ◍

DATA ON THE NILE
Frank Bell

Well I did say Egypt next, and that turned out to be the case. Nadine and I went on a Nile cruise from Luxor to Aswan and back. As I hinted at the end of article about our experiences in India I had fully intended to take my mobile satellite receiving equipment with me to Egypt. However, my published intentions prompted a cautionary letter from Ben Ramsden; thanks Ben. Egypt today is a heavily policed state and with the unsettled political nature of the Middle East, strangers operating suspicious satellite receiving equipment may not be viewed with the amateur innocence we would all profess. I considered the advice most carefully and reluctantly decided to leave my satellite receiving equipment at home. It was prophetic advice. Most people will have certainly heard or viewed the media reports of the massacre of 18 Greek tourists and the wounding of many others in an attack on a Cairo hotel by an Islamic fundamentalist group. This happened while we were in Egypt and fellow tourists and our Egyptian hosts were equally shocked by the outrage. As a small consequence of this terrorist attack, airport security on our departure from Luxor was very high and I was pleased I did not have any questionable electronics to explain at X-ray security control. I will probably take my satellite receiving equipment with me on future holidays but I will be more circumspect about its casual use.

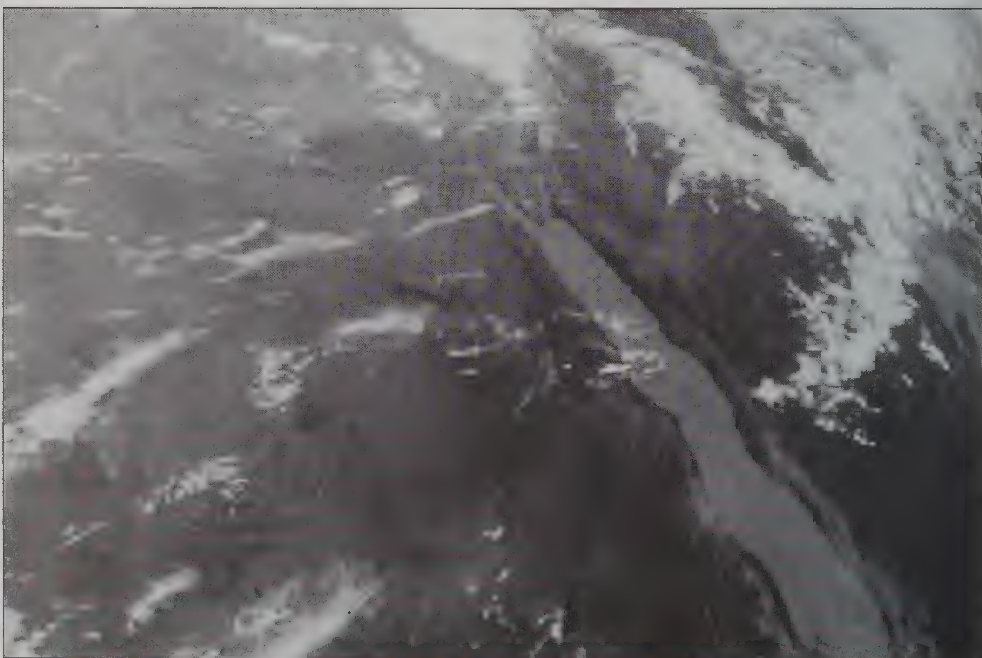


Lake Nasser shows as a widening of the river at centre of image

On reflection, even past operations in India were a bit questionable, as India is sensitive about satellite data. Images from India's own geostationary satellite Insat have not been widely publicised in the past but it is my understanding that there has been a recent agreement between the government of India and NOAA which will result in wider dissemination of Insat images. I certainly look forward to having access to these images of India and that face of the our planet.

Back to Egypt. Although I did not receive the NOAA 14 images I had planned, on returning home I did look back with interest through some archived images of Egypt and I also received a new, unencrypted, mid-day, high resolution visible image from Meteosat. Thanks Eumetsat; did something go wrong with the encryption hardware?

The reflectance of sand is about 70% to Meteosat's 0.5 - 0.9 micrometre visible wavelength radiometer. As 96% of Egypt is covered by bare rock or sand, most of the country has a bright appearance on visible images. By contrast, fresh vegetation has a reflectance of 20% to 30% and appears quite dark. As the Nile is a wide river you might think it shows up on Meteosat images and it is tempting to think the sinuous line detectable on an image of Egypt is the Nile itself. However, below Aswan the river is about one kilometre wide and is too narrow to be resolved by Meteosat even



In this infrared image Lake Naser appears cooler than the desert

on the primary data channel. What does show up well, and can be seen on the lower resolution APT images as well, is the vegetation cover parallel with the river and associated with farming and irrigation. Farming is tightly constrained by the ability to irrigate the fields and this was apparent to me in Luxor. On our way to visit the valley of the Kings I noticed many areas where just two paces would have taken you from lush fields into desert. This very sharp transition from green productive fields to desert accounts for the sharp outline of the river's course, but the river itself cannot be seen. The delta area below Cairo shows up distinctively for the same reason; vegetation cover.

Lake Nasser, just south of Aswan, is so large that it can be directly resolved by Meteosat. It is pharaonic in dimension and is the second largest man-made reservoir in the world. During the day, on visible images, it can be identified by its dark silhouette against the much lighter desert. The infrared images of Lake Nasser are interesting; during the day the lake appears lighter (cooler) than the surrounding desert but at night the lake is dark, that is warm, compared with the cold desert night.

We did visit the Aswan 41.5m High Dam and it was an impressive engineering feature. It is claimed that as well as providing valuable hydro-electricity for Egypt, the irrigation water it provides increased Egypt's agricultural area by 38%. Unfortunately, my image archives do not go back as far as 1972 so I am unable to independently verify this figure from my satellite records.

Have portable equipment, will travel. Where next? ⊕

PRESS REPORT

World News Bureau, London, 20 June 2002.

The long-running talks between the Remote Imaging Group and the Radio Communications Associates plc (formerly Radiocommunications Agency) broke down in the early hours of this morning with no agreement and no further talks planned.

The President of RCA, Wayne G Kawalski Jnr, speaking from his luxury penthouse office atop the multi-million pound marble and glass communications complex on London's South Bank on the site of the former National Theatre and Royal Festival Hall, said "We are in the business of looking after the commercial boys and making money. If RIG has a couple of million pounds to spend then we might listen to them."

Following the breakdown of the talks, explosions were reported to have occurred at

many pager transmitter sites throughout the UK causing considerable damage and severe disruption to the UK pager services. The attacks are believed to be the work of the banned organisation Justice and Consideration for Amateur Users of the Radio Spectrum, which is thought to have infiltrated the RIG membership. So far, there has been no comment from RIG's Chairperson, Amanda Braithwaite, or the committee who are holding an emergency meeting at a secret location in Welwyn Garden City.

Meanwhile, RIG appears to have found an unlikely ally in the World Mobile Satellite Communications Corporation, who share the 137-138MHz meteorological satellite band and who are now also suffering increasing interference to their services from new pager allocations throughout the band. It is rumoured that they may be financing the 'Justice and Consideration' organisation.

Hopefully, just a bad dream (including Amanda Braithwaite!), but you will have read in another article in this issue about the exciting proposals for the new (137MHz) LRPT services from the new satellites we can expect around the turn of the century. You will also have noticed, with horror if you live in the UK, the change in downlink frequencies to 137.10MHz and **137.9125MHz**. With the required receiver bandwidth of 150KHz, the upper channel will just not be receivable by a large number, possibly the majority, of UK members.

I have already set the wheels in motion and written to NOAA, EUMETSAT, the Radiocommunications Agency, the WMO and the Met. Office requesting comment on the apparent conflict in the UK. To date I have received no responses. I urge all members to show restraint at this early stage. John Tellick.

FOR SALE. US Robotics Sportster 14,400 Baud Internal PC modem, including Comms software and delivery £60. Tel Mark Pepper (UK) +44 (0)1344 777730.

FOR SALE. Martelec JVF1 APT, HF FAX, SSTV interface, instructions £40. Tel Mark Pepper (UK) +44 (0)1344 777730.

FOR SALE. PROsatII card, software, dongle, instruction book, 6 months old. Have upgraded to Windows version. £50 ono. Tel John Garner 01752 812904.

FOR SALE. Altron Tower, three section, ground post and three-element beam. Tel Nick Williamson 01375 390520 (day-Aspect Insurance) or 01375 373718 (evenings).

WANTED. Second-hand HRPT equipment. Timestep or similar. Write Hug Texido, PO Box 24, 08191, RUBI, Spain.

SATTRACK

John Boyer (G0WRX)

This article is dedicated to RIG members who are users of X-terminals, Linux PCs, SGIs and the like. If you are not one of these then don't bother reading this.

SatTrack is a satellite prediction program written in C for UNIX/Linux platforms. I installed SatTrack on my X-terminal at work and on my PC (running Linux) at home and for me it's a great alternative to the usual DOS/Windows programs that are about.

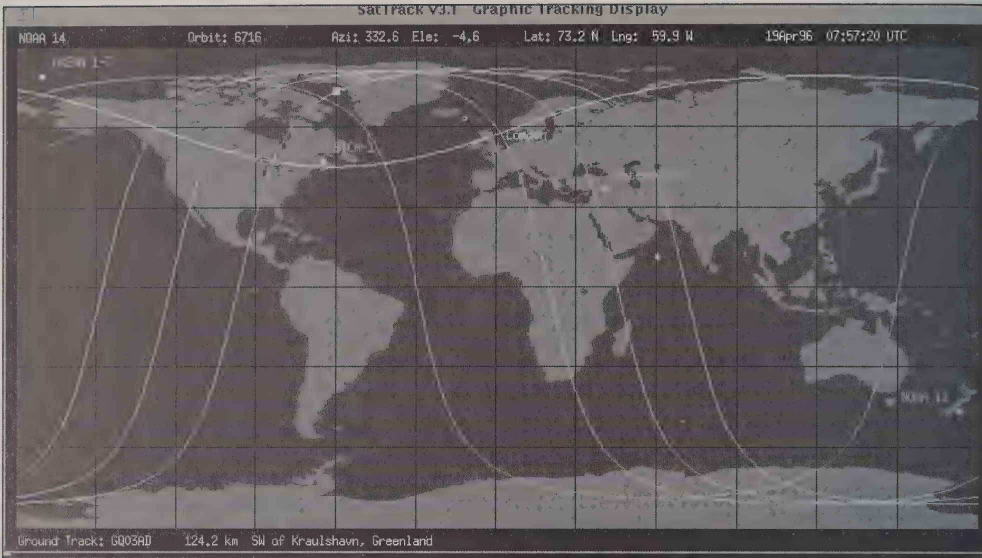
You can get hold of SatTrack from the Internet's World Wide Web. The easiest place to visit is probably it's home page! There aren't many pieces of software that can boast their own homepages! The URL is http://www.primenet.com/~bester/sattrack.html. There are all sorts of interesting bits about SatTrack showing example displays and how to install. However, for those of you who don't have web access I am sure that by the time this journal comes out a copy will be available from the RIG shareware library. Although it will run in X Windows and give you a nice graphical display, it will also run in a text mode. So those of you who really do want to run it from a VT100 terminal can do so.

```
SatTrack V3.1                                   GROUP WX MULTISAT TRACKING DISPLAY
                              g0wrx
 Ground Station: London, England, UK                      Tracking:  OFF                   Date: Wed1         1
4:00:3059:05UTC: ___  __:__:__
   Satellite     Countdown   Next AOS/LOS  Duration MEL  Visib  Azi Ele   Range M               Groun
d Track Location
 NOAA 14 ......  0/00:07:17  122/14:07:47  0:08:42  38  DDD D  274  38 \  1285 G  322 km WSW Shannon, Ireland
 OKEAN 1-7 ....  0/00:37:32  122/14:38:02  0:09:07   7  DDD D  203 -72 / 12782 G  871 km WSW Siple Station, Antarctica
 SICH-1 .......  0/01:14:57  122/15:15:27  0:06:31   3  DDD D  184 -31 \  7709 G  404 km SSE Saint Helena Island (UK)
 Meteor 3-5 ...  0/01:36:08  122/15:36:38  0:08:19   3  DDD D   51 -18 \  6576 G  719 km WSW Irkutsk, Siberia, Russia
 NOAA 12 ......  0/01:46:09  122/15:46:39  0:11:04  10  DDD D   89 -22 /  6537 G  209 km ENE Karachi, Pakistan
```

SatTrack calculates orbits using the Simplified General Perturbations, version 4 (SGP4) orbit prediction algorithm for low-earth orbit satellites and for satellites that have a period of longer than 225 minutes it uses a simplified TLE mean model. You may think I am dead clever figuring all this out but it's in the blurb. The quality of the documentation is excellent apart from one small point that I will come back to later.

To install SatTrack you need to edit the makefile so that it reflects your system and you need to also edit config.h (in satTrack/src/include) and defaults0.dat (that's in SatTrack/data) so that SatTrack runs in the mode you require. This includes telling it what your X display is. You can find this out by typing env from a prompt. Next you compile the program by going to the src directory and typing make. The best thing to do is read the file called README_MAKE. Another nail in the coffin of DOS - here filenames are meaningful.

When you run SatTrack you get asked questions about your ground station etc. When you have answered these questions you get a display like the one illustrated. This is



a real-time display that updates every 5 seconds. There is a whole set of keys you can use to good effect but one really useful one is the letter g. This one took me ages to find as it isn't really obvious until you have read the documentation carefully. The g key will open up a graphics window if you are running SatTrack from an X prompt. A sample graphics screen is illustrated. The real beauty of this system is that you can see the text window and the graphics window at the same time. The currently selected satellite is changed by using the u or the d key to move the > symbol up and down the list and this is automatically reflected in the graphics window.

There are many other features to this program, including rotator control, but the aim of this article is not to write comprehensive documentation on SatTrack, but rather to whet ones appetite. ⊕

RIG*sat* RX1 - RX1A - IF1 UPDATE

Ray Godden & Bryan Taylor

RX1

No new problems have been reported but there is a simple modification that will often improve performance. Supplies of the IF crystal filter have been completely exhausted so unfortunately this looks like the end of this project - many orders have had to be returned.

The modification

In some circumstances RF energy from the output stages of the IF chip can be fed

back to the front end of the receiver. The symptoms are that the signal strength output level under no-signal conditions is rather high and varies as connections are moved and the sensitivity is degraded. The cure is simple. Remove the supply bypass capacitor C21 by cutting its leads. Solder a 1n capacitor, with its leads as short as possible, between the end of R15 (39) remote from the IC and the ground plane (top) of the PCB. This modification seems to improve performance in most cases.

RX1A
No problems have been reported.

IF1
This has been very popular and the initial batch of 200 boards will soon be sold out. Another order is under consideration. At the time of writing there has not been a lot of feedback from constructors. Some have experienced difficulties finding an I/O card that is suitable. It has to be truly bi-directional. Recommended I/O card for the IF1; order from MJ Woudstra, 15 Amherst Road, Bexhill-on-Sea, TN40 1QH. Tel 01424 731836. Order as I/O card PTI-227W price £10 UK, £12 Europe, £14 rest of World. No credit cards. Ports described as 'Bitronic' are not compatible. Many computers offer a set-up option to set the motherboard printer port bi-directional but this does not always seem to work. Data is input to the computer but the interrupt is not enabled. In these circumstances JVFAX can be used in 'parallel port' mode. Some users have added a parallel/serial converter (see Mark Pepper's article in RIG 35). The IF1 needs about 100mV rms of signal to produce digital 255 (peak white); if the output signal level from your receiver is less than this increase the value of R3. If the interface operates at 2.4kHz but not at 4.8kHz this could be due to the speed of the internal clock of the 0804 being too low to complete conversion in the available time. Try reducing R20 from 10k to 8k2. On some systems it has been found that if JVFAX Quicksave is selected synchronisation is disturbed and the image steps across the screen. The cause is not known but we are endeavouring to contact DK8JV for an opinion. In some cases reloading JVFAX has cured the effect.

Component kits
Many any of you have been frustrated by Cirkit's propensity to run out of stock. We are trying to establish a relationship with them to improve matters. Possibly another supplier would do better. Preparing kits ourselves has been considered but the work-load would be high and no volunteer has come forward.

Feedback
We would like to hear more from *you*. Information about your experiences, problems, cures, any opinions you have, or special knowledge, helps ourselves and others to get good results from RIG*sat* projects and encourages us to make the effort to produce new designs. ⊕

SOMEONE HAS FOUND AN "ANTIDOTE" FOR "PAGER PLAGUE"!

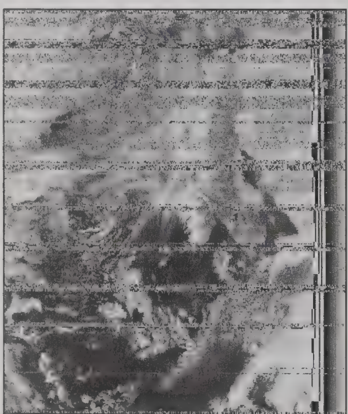
If you have heard rumours in recent weeks to this effect you could be forgiven for doubting their veracity. It was, after all, the season for playing cruel and carefully crafted pranks on the gullible and unsuspecting. However, this is no joke.

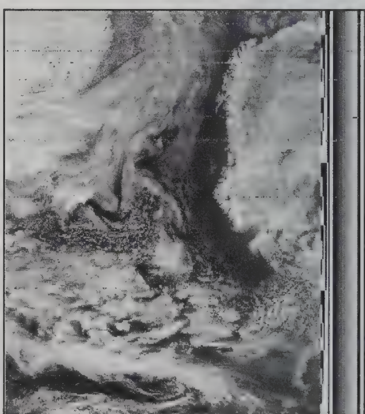
Two RIG members, Hugh Pearson from Bristol and Barrie Stevens from Monmouth, have been actively working on a system to combat this menace since January and have now come up with a solution that shows great promise.

It is early days yet and there are a number of snags still to be ironed out. However, a look at the images provided by Barrie should help to convince those members who have to endure this debilitating complaint that their days of suffering may (hopefully) soon be over.

The images are from Meteor 3-5 (on 137.850MHz) with a pager transmitter happily blazing away on 137.975MHz within 2km of his home. They were received via a standard turnstile antenna feeding a home-built RIG receiver. The one exhibiting the all too familiar stripes of noise was from a near-overhead pass on 2 April without the anti-pager device in operation.

The second image was from a pass slightly to the west of Britain on 31 March using exactly the same receiving equipment but, on this occasion, Barrie had the "magic box" in circuit.





Impressive eh? And that's only the prototype. So how's it done and when can you have one of your own to play with? Sadly, Barrie and Hugh have been so busy trying to beat the remaining bugs out of their new box of tricks that they missed the publication deadline for this issue of the journal. However, they hope to be in a position to reveal some (if not all) in number 46. In the meantime you'll just have to be patient. HP.

LOW NOISE BALANCED NARROW BAND AMPLIFIER

Darren Conway

Introduction

One of the major difficulties with receiving satellite signals is that they are very weak compared with the the strength of signals from any nearby transmitters. This immediately defines two requirements of a satellite receiver system. The receiver must have a low noise figure so that weak signals are not significantly degraded by noise in the receiver. Secondly, the receiver must have a wide dynamic range so that none of the amplifier stages is driven to a saturated, non-linear state by radio interference. Saturation causes harmonic generation within the receiver and compresses the wanted signal. In effect, saturation reduces the signal-to-noise ratio.

This article presents the case for using a masthead amplifier and describes a design specifically intended for satellite reception using a balanced antenna. The amplifier has a narrow bandwidth to attenuate out-of-band interference and remains linear in the presence of high levels of in-band interference.

Noise Figure Calculations

The noise figure of a typical receiver system is largely determined by the noise figure of the first stage RF amplifier. The noise figure of a receiver system is given by the following equation:

$$NF = F1 + F2/G1 + F3/G1.G2 + ...F_{n+1}/G1.G2...G_n$$

where F is the noise figure for each stage and G is the gain of each stage.

As an example this equation will be applied to a simple receiver front end made up of a 1st stage amplifier followed by a passive mixer and then a 2nd stage amplifier, as shown in Figure 1.

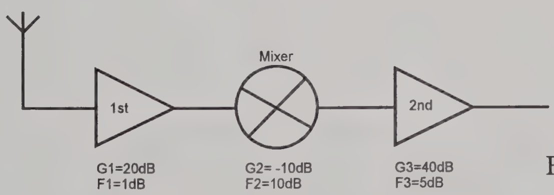


Fig. 1

Inserting these figures into the equation for the receiver noise figure gives:

$$NF = 1 + 10/100 + 5/100x0.1$$
$$NF = 1 + 0.1 + 0.5$$
$$NF = 1.6$$

Using this simplified example, it can be seen that the noise figure of the whole receiver can never be less than that of the first amplifier. The noise figures of the following stages are reduced by the cumulative gain of the previous stages. In the above example, the difference in gain between the first amplifier and the mixer is 1000x while the noise is 10x greater and yet the overall noise figure increases by 0.1. The 2nd amplifier adds only 0.5 to the overall noise figure. The dominant source of noise within this receiver is the 1st stage amplifier. The effect of noise in the following stages can be reduced by increasing the gain of the 1st stage amplifier.

The noise figure of the first stage amplifier includes any cable or balun losses be-

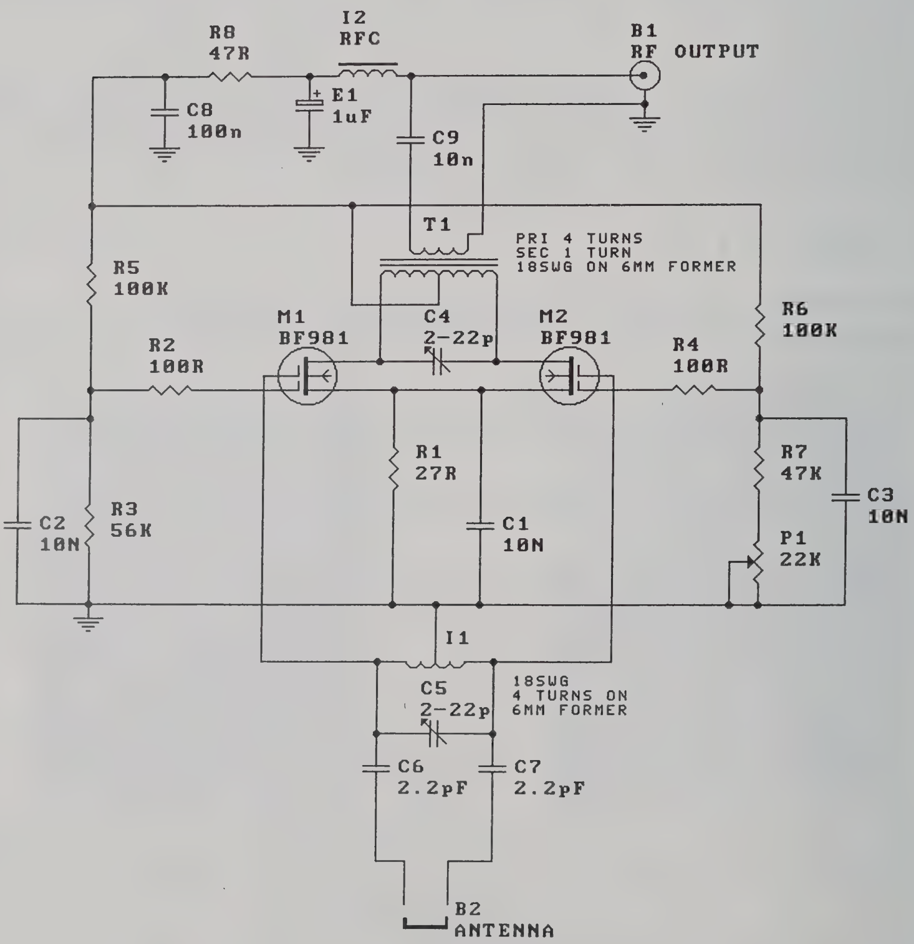


Fig. 2 Circuit diagram

tween the antenna and amplifier input. Therefore, connecting the antenna output directly to the first stage amplifier can significantly improve the the overall noise figure, particularly if there is a long cable run between the antenna and the receiver. This is the justification for fitting masthead amplifiers.

Masthead Amplifier Gain

While the above argument may indicate that the gain of the masthead amplifier should be as high as possible, this is not the case. Adding gain at the first stage has the effect of reducing the dynamic range of the receiver and increasing the risk of saturating latter stages. The optimum gain of the masthead amplifier depends on the performance of the receiver and the local conditions. At sites with a good receiver and no nearby transmitters, a very high gain (>25dB) masthead amplifier will give the best results. More typically, in populated areas where there are a number of unwanted transmitters of all descriptions, a lower gain (5dB to 20dB) that amplifies the weak satellite signals without causing the receiver to be saturated by nearby strong signals will produce the best results. Good quality receivers typically allow the operatorto vary the gain of the first stage amplifier which is very useful when a masthead amplifier is used. For receivers without this feature, in-line attenuators can be inserted in the antenna feed at the receiver.

A New Masthead Amplifier

Commonly available masthead amplifiers have an unbalanced input which requires the use of a balun between the masthead amplifier and a balanced antenna such as a Lindenblad. A well designed balun will have at least 1dB insertion loss which is greater than the noise figure of a typical low-noise masthead amplifier. The masthead amplifier design presented here has a balanced input that allows direct connection to a balanced antenna and eliminates the balun.

The amplifier is specifically designed for reception of signals in the range 137 to 138 MHz but the centre frequency can be varied over a wide range by selecting suitable values for the tuned components. The amplifier has 28dB gain and a low noise figure. A 12V to 15V power supply is required down the coax.

Two very low noise MOSFETs act as parallel amplifiers to eliminate the balun at the input and improve the dynamic input power range when compared to a single device amplifier. Sharing the input signal between two MOSFETs means that the amplifier will accept a 3dB higher signal before overloading compared to a single device amplifier. This in turn raises the 2nd order intercept point by 6dB and the 3rd order intercept point by 9dB.

Balance within the amplifier is achieved by a symmetrical circuit layout and by the

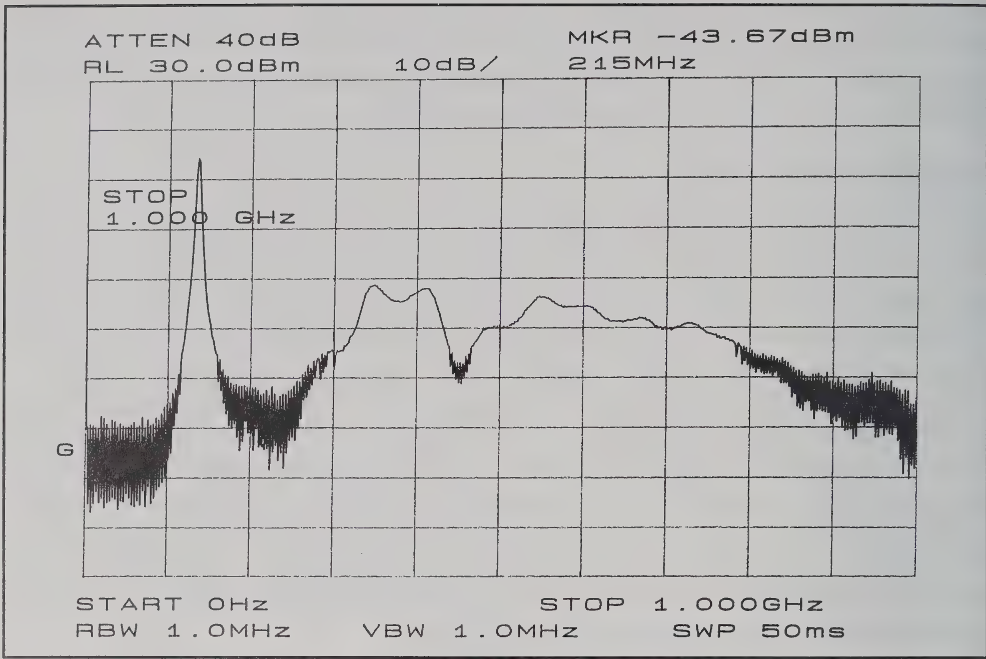

ATTEN 40dB
RL 30.0dBm
10dB/
MKR -43.67dBm
215MHz
STOP
1.000 GHz
G
START 0Hz
STOP 1.000GHz
RBW 1.0MHz
VBW 1.0MHz
SWP 50ms

Fig. 3

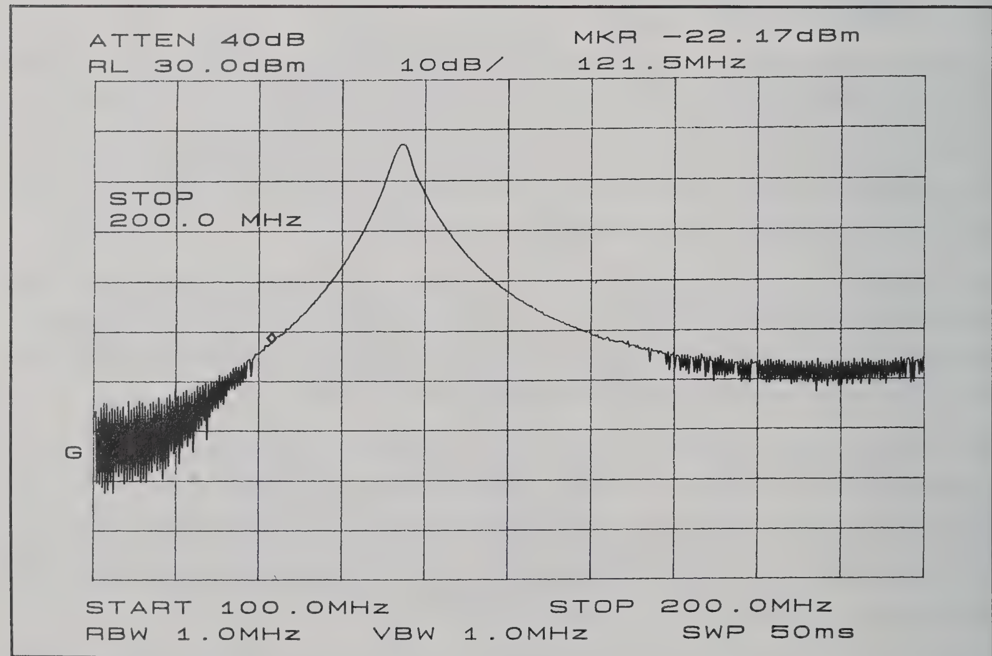

ATTEN 40dB
RL 30.0dBm
10dB/
MKR -22.17dBm
121.5MHz
STOP
200.0 MHz
G
START 100.0MHz
STOP 200.0MHz
RBW 1.0MHz
VBW 1.0MHz
SWP 50ms

Fig. 4

input and output inductors. The transformer action of these inductors compensates for any gain variations between the two MOSFETs. This is so effective that varying P1 over its full range has no observable effect on the overall performance of the amplifier.

Good circuit layout and proper shielding is critical for the correct operation of such a high gain amplifier. The amplifier is constructed on a double-sided PCB using surface mounted devices to minimise parasitic reactances. The BF981 has the advantage that the SOT-103 package can be mounted on its 'back' so that the RF signal paths through both MOSFETs are symmetrical.

The setting-up procedure consists of setting the bias current with P1 and adjusting the two trim capacitors to achieve maximum amplifier output at the desired input frequency.

Amplifier Performance

There are many amplifier designs in reputable publications claiming superior performance without the slightest shred of supporting evidence. For this design, plots are included that confirm the performance.

Fig 3. Plots the output signal amplitude for a signal swept from 0Hz to 1GHz. The hump at about 700MHz is due to self-resonance of a temporary DC blocking circuit used to isolate the supply voltage from the spectrum analyser input. This shows that there are no unwanted gain peaks across the radio spectrum.

Fig 4. Plots of the output signal amplitude for a signal swept from 100MHz to 200MHz. This demonstrates that the amplifier has a 3dB bandwidth of only 2MHz making it resistant to out-of-band interference and ideally suited to receiving signals in the 137-138MHz range.

Fig 5. Plots the output frequency spectrum for a 0dBm input at 137.5MHz. Even at this high input level, the 2nd harmonic is down 30dB while the third is down 50dB. A 0dBm signal corresponds to an antenna output of 225mV which could only be achieved if the antenna was located very near to a powerful transmitter.

Fig 6. Plots the output frequency spectrum for a -30dBm input at 137.5MHz. At this lower input level, the 2nd harmonic is down 50dB while the 3rd is down 70dB. This is still a strong signal compared with a satellite and demonstrates that this amplifier responds very well to in-band interference.

Fig 7. Plots a range of input signal levels at 137.5MHz versus the output levels of the fundamental, 2nd and 3rd harmonics. The 1dB compression point occurs at about -

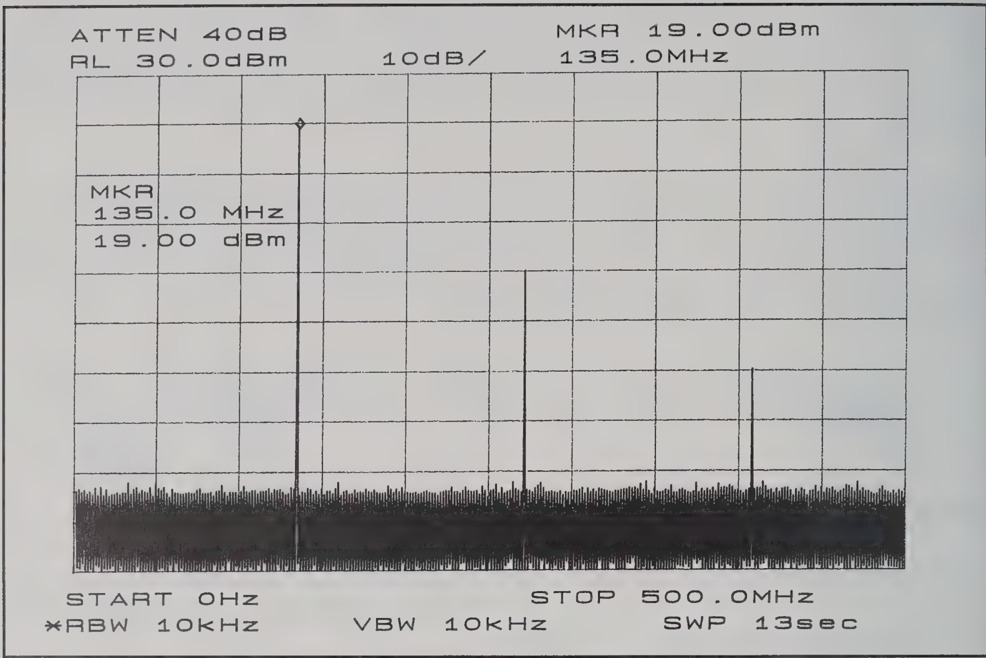

ATTEN 40dB
RL 30.0dBm
10dB/
MKR 19.00dBm
135.0MHz
MKR
135.0 MHz
19.00 dBm
START 0Hz
STOP 500.0MHz
*RBW 10kHz
VBW 10kHz
SWP 13sec

Fig. 5

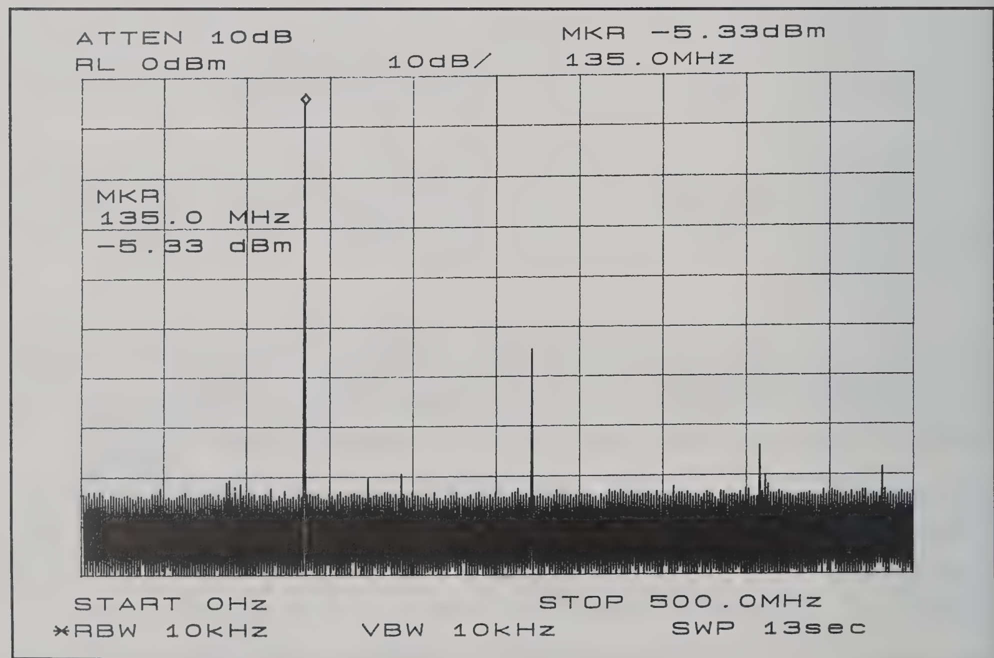

ATTEN 10dB
RL 0dBm
10dB/
MKR -5.33dBm
135.0MHz
MKR
135.0 MHz
-5.33 dBm
START 0Hz
STOP 500.0MHz
*RBW 10kHz
VBW 10kHz
SWP 13sec

Fig. 6

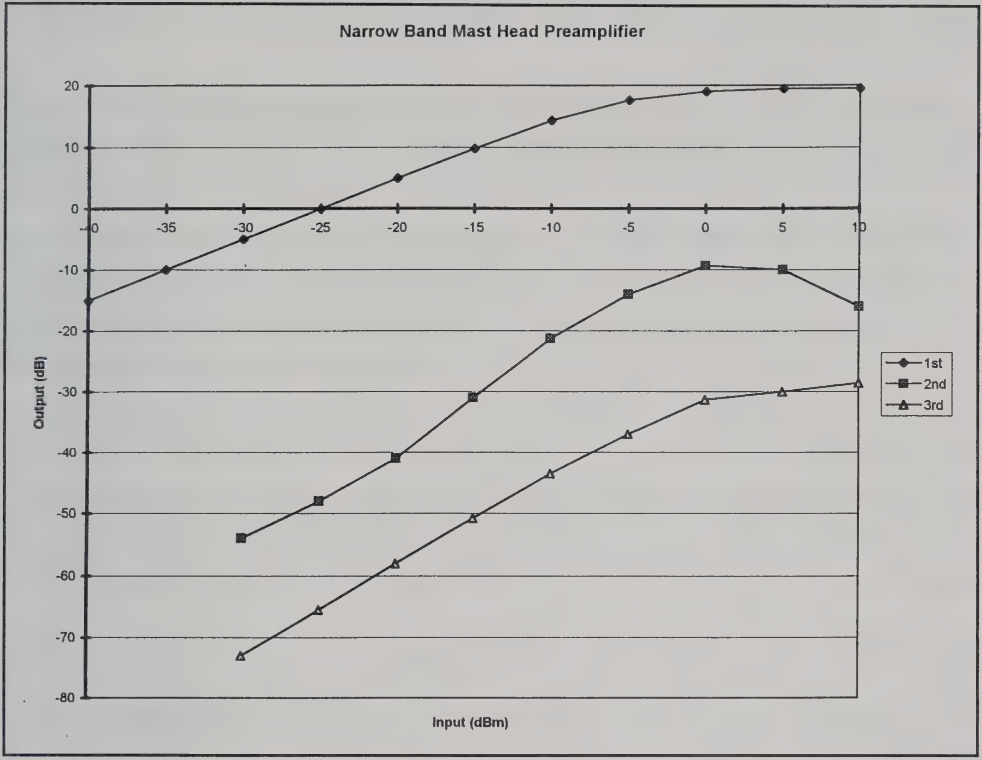


Fig. 7

5dBm while harmonic suppression is good even at high input levels.

Summary

This amplifier is suitable for use with a balanced antenna for the reception of weak satellite signals. The narrow bandwidth provides good rejection of high level out-of-band interference. The use of two MOSFETs to share the load significantly reduces harmonic levels for high level in-band signals.

Availability

Printed circuit boards with instructions but no components may be supplied for $20NZ each. At the current exchange rate one pound will buy about 2.1 New Zealand dollars.

Please contact Darren Conway directly at:
73 Alexander Avenue, Torbay, Auckland. New Zealand. ⊕

LEDs FOR PHOTOGRAPHIC FAX MACHINES

Graham Smith, G1JVZ

The current price of high intensity, blue LEDs[1] as used by Andrew McGuffie in RIG 41 and 42 is £16.25 including VAT and postage for 1 off. They are quite affordable now and will probably become cheaper with more being produced.

Combined red/green/blue LEDs[2] will soon be available from the same source[3], with one red, one green and two blue chips in the same package. Maximum outputs at 20mA are 300, 200, 5.0 and 5.0mcd respectively. They can produce any colour in the visible spectrum including white light. I would like to know how well they work with colour photographic paper or colour reversal paper on a rotating drum fax and, in particular, whether the blue chips are bright enough to match the other chips for our purposes. If you have a colour darkroom, please have a go. Price will be £12.36.

I am told that Sharp have a RGB device but minimum order quantities are substantial and it may not be available in Europe. I shall investigate.

References

1. Nichia blue LEDs. NLPB300 to NLPB250 range.

2. Kingbright T-1 3/4 (5mm) full colour rgb LED lamps water clear LF59EBGBC. White diffused LF59EBGBW.

3. Hero Electronics Ltd, Dunstable Street, Ampthill, MK45 2JS. Tel 01525 405015. Fax 01525 402383.

MEMBERS' ADVERTISEMENTS

Members may advertise surplus equipment etc. for sale in the journal free of charge but subject to space being available. Advertisements should be concise and must pertain to RIG activities. They should be submitted to the journal editor and not the advertising manager.

FOR SALE. Timestep PROsatII card and software including Track II and colour animate. Complete with dongle. £60 Tel Roger Ray, 01952 257077.

FOR SALE. Timestep PROscan RX in metal box, PROsat interface and software including Track II. 200. Digisat v 6.2 Interface and software 100. Tel Fred Pieters (Belgium) +32 (0)9 282 8842.

THE MILLENNIUM SATELLITE
Frank Bell

I promised to keep RIG members up-to-date with the progress of this satellite project. There has been a major development since my last report and I am very pleased to inform members that after much consideration the Millennium Commission have put this educational and amateur satellite on the list of projects it is willing to support. There has been a great deal of discussion with the Millennium Commission over the past six months. It appears that they see the project as distinctive, employing high technology, demonstrating British skills and achievements and acknowledging that the satellite's data will be widely available to many users in the UK, (not to mention elsewhere in the world).

A company, the Millennium Satellite Centre Ltd., has been formed to run the project. The company has a number of knowledgeable and influential directors with experience in business and the space industry. These directors and their consultants have put a lot of effort into establishing a suitable structure for the company. Helen Sharman is a director and I hope one day you will see her on the television promoting this satellite project to the general public.

There are many details still to be decided before the Millennium Commission will hand over the £3.3 million the company has requested. However, we are very active and we anticipate that by June 1996 we will be able to give the Millennium Commission a complete picture of all business, technical and financial aspects of the proposal.

Although schools will be the primary target users, I fully expect there will be many other people with related science, space, technology, amateur radio, computer and communication skills who will also be actively interested in exploiting the potential of live satellite data. This of course includes RIG members, because one of the primary mission objectives is that the satellite shall carry a multi-spectral CCD camera for imaging different parts of the planet.

I am trying to gather together ideas and suggestions for other payload instruments and experiments. I would like RIG members to give some detailed thought to this. I would be delighted to receive ideas and suggestions for additional experiments but bear in mind the tight mass constraints; the total payload mass can only be about 10kg and the payload power consumption must not exceed a few Watts. Currently the payload and experiments are grouped into themes. There is a solar theme, to follow sun-spot cycles, solar radiation and auroras; particle physics, magnetism, radio propagation and the protective nature of the Earth's atmosphere are further themes which are being considered. If you wish to submit an idea please do so quickly to the school address at the end of this article and not to my home address.

The project is generating a data base for those individuals and institutions who are interested in this satellite project. If you are interested in registering then please use the form below. Either photocopy the form or just write out your details on a piece of paper using the layout of the form. No electronic registrations at the moment please, it's something we are working on. People who have written supportive letters to me; thank you; you have already been entered on the data base. I will try to keep RIG members informed of progress via this journal. The satellite at this moment does NOT HAVE A NAME; suggestions please!

Replies to :-
Millennium Satellite Centre Ltd.,
D.B. Registration
C/o Royal Grammar School,
PO Box 289
GUILDFORD UK GU1 3WY

Title________________ First Name______________ LastName_______________

School/Organisation_________________________ Telephone_______________

Street/Road_______________________________ Fax Number_______________

Area______________________________________ Email Address____________

Town___________________________________

County______________ Post Code______________ Country________________

Education interests - Please enter (H)igher (S)econdary (P)rimary (N)one_________

Tick if applicable

Radio Amateur___ RIG Member__ AMSAT Member___ Computer Interest___ Other__

Your idea(s) for payload instruments and experiments_______________________

____

The Satellite does not have a name! The satellite's name should be_____________

General Comments____

____

SUMMARY OF THE LRPT SYSTEM

[Those members on NOAA's mailing list will already have received this information but for the benefit of others, it is reproduced here. Ed]

Starting with the launch of the European METOP-1 satellite, expected in 2002, the Low Rate Picture Transmission (LRPT) will provide a digital transmission of AVHRR imagery and atmospheric sounding data to users worldwide. The LRPT will be a similar direct broadcast service as the current Automatic Picture Transmission (APT) from NOAA polar-orbiting environmental satellites. The LRPT is also envisioned as the next generation APT system on NOAA-sponsored satellites, beginning after NOAA-N′, which will provide full resolution images and sounding data from an enhanced imager/radiometer starting later in the next decade.

There are many significant differences between APT and LRPT systems that will be of interest to direct broadcast users. Some upgrades to the current APT ground receive systems are required to receive and process the LRPT data stream. (Note: NOAA's plan is to continue broadcasting APT images until the NOAA-N and -N′ AVHRR imagery is no longer available or the satellites are decommissioned, expected around 2004-2006). The LRPT data to be broadcast from the METOP satellites has many unique features which are listed as follows:

1. The LRPT link follows the Consultative Committee for Space Data Systems (CCSDS) standard for Advanced Orbiting Systems which is based on the OSI reference model. Each instrument data is embedded into separate telemetry packets: this allows a higher flexibility and an improved data link quality because of the various error-checking systems allowed by the protocols.

2. The LRPT consists of data from AVHRR, HIRS, AMSU-A and MHS. Other sensor data may be added to LRPT by additional European payloads on the METOP series of satellites. The content of the LRPT data stream will be coordinated between NOAA and EUMETSAT in the year ahead.

3. HIRS, AMSU-A and MHS sensor data, which provide atmospheric temperature and moisture information, will not be compressed.

4. AVHRR will provide either 2 or 3 channels of imagery depending on several issues, including data quality, complexity of compression, link budget issues, etc.

5. In order to achieve an improved resolution of 1.1km at nadir versus 4km for APT, AVHRR data will be compressed with a compression ratio of 8. The selection of a compression algorithm is based on the following criteria:

a. Availability of an internationally accepted image compression standard
b. Limited complexity
c. Good performance and quality of images
d. Worldwide availability of the source code
e. Attractive price

6. Further studies will be conducted to optimise quantization and coding tables in an attempt to improve the quality of images.

7. AVHRR spatial resolution will be retained (1.1km at nadir, and approaching 7km at edge of scan).

8. All instrument housekeeping data will be contained in the spacecraft telemetry packet.

9. LRPT data will be broadcast at 137.1 and/or 137.9125MHz by the METOP series of satellites. These same frequencies will be used by NOAA-N and N′ in the APT downlink (a change from the current APT frequencies).

10. Users should be aware of the following characteristics of LRPT that may require new/upgraded receiver equipment in order to collect LRPT data:

a. LRPT will require a higher bandwidth (150kHz) in order to transmit all the desired data to the user community.

b. A replacement of an analog facsimile demodulator with a DQPSK demodulator and a CCSDS packet interface will be necessary.

c. A Pentium-like processor will be needed to process the LRPT data.

d. Basic software to handle packets and to decompress data may be provided by NOAA/EUMETSAT. The issue of how to demodulate the data will be addressed later this year.

e. Software to display at desired resolution and a map projection may be provided by NOAA/EUMETSAT.

11. The LRPT system for the NOAA-sponsored environmental satellite programme beyond NOAA-N′, called NPOESS, will be similar to that used by the METOP series. Since NPOESS plans to incorporate an upgraded sensor suite, some changes in data content are inevitable. (NPOESS is a future converged US military/civilian mission currently under development within NOAA). 🌐

HRPT THE EASY WAY

Guido Emiliani, I4GU
Marciano Righini, I4MY
Giampaolo Rossini, IW4CSG

[Reprinted from QEX, September 1995]

Say you've been receiving the NOAA weather satellite APT signals on 137.5 and 137.62MHz for years, and you're proud of the fine pictures that you can display on your PC monitor. Analog APT has been a very successful system of weather image dissemination - it's simple to receive and convert to pictures.

But APT transmits only one third of the lines generated by the AVHRR, the instrument that scans the Earth's surface and produces the images. All the NOAA instrument data are included in the HRPT digital transmission, but you thought that displaying all the lines would go beyond your technical and economical capabilities. This was probably true a few years ago, but now - well, let's see if it is still true.

We'll examine the difficulties of homebrewing an HRPT receiving station, but we'll also discover how easy it is if you have a good signal at your disposal. In fact, the greatest difficulty is acquiring a strong and steady signal from the satellite. If you can do this, the rest of the system is within the capacity of a homebrewer, and the software necessary to complete the system is available free to everybody.

Radio Frequency Section

These are the components of our RF section:

a) A 1.4m dish with a f/d ratio of 0.38.

b) A cylindrical horn, 17cm long and 12cm in diameter, at the focus of the dish. Inside the horn, two quarter-wave monopoles (probes), each 4cm long, are placed at 4.5cm from the horn's back end, 90 degrees apart. To obtain circular polarization, one monopole must be fed 90 degrees out of phase with respect to the other. The delay is obtained with two lengths of RG-59: one 11.65cm long (λ), and the other 14.55cm long ($\lambda + \lambda/4$). The proper polarization is is left-handed (the dish inverts the right-hand polarization from the satellite); thus, circling counter-clockwise, the first probe you meet should be connected to the longer cable. The ends of the two cables are connected together and go to

c) A low-noise amplifier (LNA) for 1700 MHz, to be placed at the rear of the horn.

d) Yaesu G-5400B dish azimuth and elevation rotators.

e) The Kansas City Tracker (which is optional, because tracking is easy with this system).

f) A downconverter that converts the HRPT signal to a "transportable" frequency. (If your receiver can tune the S band and is close to the dish, you may not need a converter.

g) An ICOM IC-R7000 receiver, with which we receive the converter's output frequencies or (if we don't use a converter) the NOAA satellites' frequencies (1698 and 1707MHz). The R7000's rear panel includes a jack that outputs a 10.7MHz 2nd IF signal. We use this signal to drive our HRPT decoder. (Be careful: this jack also sources 9V dc, so you may need to use a blocking capacitor.)

There are many more possible arrangements, but we agree on one point: If you cannot install the "external" part of the system (items a, b, c, d), this project is not for you. Again, the secret for success is *a very good RF signal from the satellite.*

Fig 1 block-diagrams the "internal" part of the system- the hardware described in this article.

10.7MHz Amplifier and Band-Pass Filter

See Fig 2. Because the signal level from the 10.7MHz output of the R7000 is very weak, we need amplification to drive the following stage. A white dot marks the input of the MAR-6 MMIC, and the output is the pin on the opposite side. The other two pins must be grounded.

The filter, consisting of two FM2/3 IF transformers, should have a bandwidth of about 1.5MHz at -3dB. This is a critical section of the system; if you do not have the proper test equipment (as is our case), you will have to adjust it on the satellite signal for a noise-free picture.

Phase Demodulator and Split-Phase-Low to Nonreturn-to-Zero Decoder

See Fig 3. This section performs the following functions:

a) It demodulates the 10.7MHz RF signal (in IC1, a Plessey SL1451) and a split-phase-low (Manchester) coded signal.

b) It decodes the SPL data into nonreturn-to-zero (in IC3, a Harris HD-6409).

IC1 is a Plessey PLL FM detector intended for satellite TV reception. [1] Inside the chip is a transistor (pin 3 emitter, pin 4 base, pin 5 collector) that must be connected to an

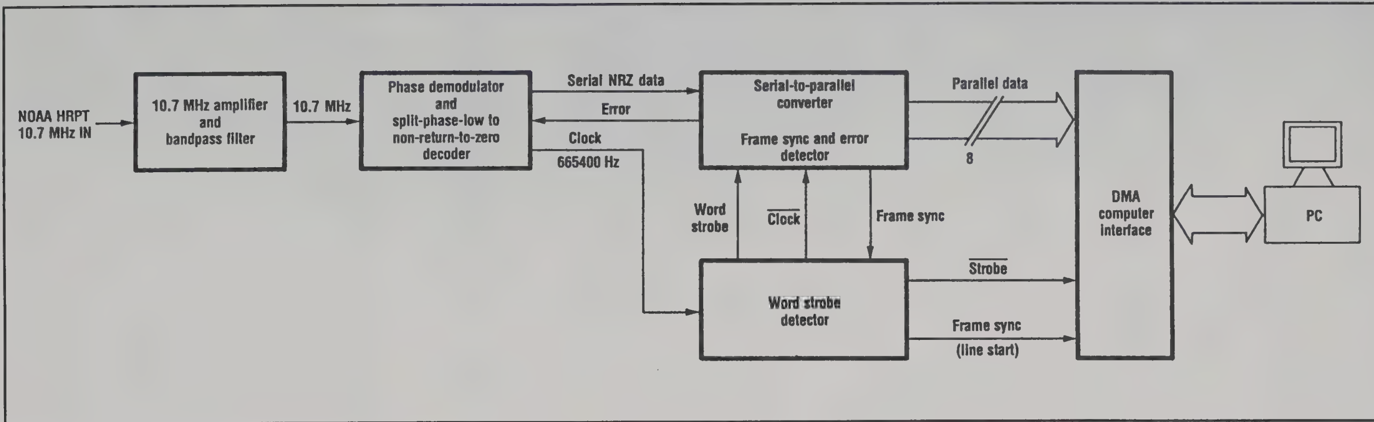


Fig. 1. Block diagram of HRPT system

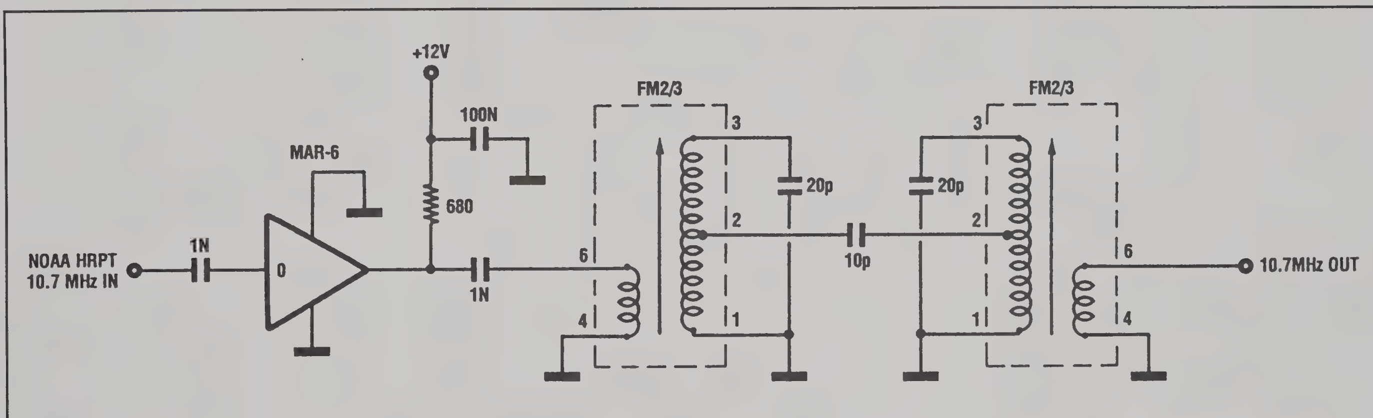


Fig. 2. The 10.7MHz amplifier and band-pass filter

Transmit frequencies	1698 or 1707MHz
Polarization	Right hand circular
Carrier modulation	Digital split phase, phase modulated
Lines per frame	1
Line rate	6 per second
Number of words	11090 per line
Word rate	66540 per second
Number of bits	10 per word; bit 1 =MSB (transmitted first)
Bit rate	665400 per second
Words per image	2048 per line
Spectral channels	5:
	Channel 1 0.58-0.68 μm
	Channel 2 0.725-1.1 μm
	Channel 3 3.55-3.93 μm
	Channel 4 10.3-11.3 μm
	Channel 5 11.5-12.5 μm

Table 1 - HRPT parameters

external coil (in our case, a small IF transformer) to act as an oscillator at 10.7MHz. The HRPT signal from the filter of Fig 2 is fed into pin 11. The video output (pin 14) drives a dual tuning diode (D1, a BB204) via isolating network L1-R1. It also drives the SL1451's loop feedback 1 input (pin 1) via the filter consisting of C1 and R2. The gain of the SL1451's internal input RF amplifier is programmable by varying the voltage on pin 10; the gain is maximum with pin 10 connected to V_{cc} via a 330kΩ resistor.

The 665.4 kbit/s split-phase-low signal passes through a post-detection low-pass filter (R3-C2), which is designed to cut off above twice the bit rate (1330.8kHz), and on to IC2, which outputs it at a 5V level.

The decoding process is based on an HD-6409 Manchester encoder-decoder (Harris Corporation), a chip that converts Manchester code into NRZ code and provides clock recovery. The SPL data is fed into the decoder's Unipolar Data Input (UDI) pin. The HD-6409's SDO (serial data out) provides decoded serial NRZ data synchronous with the decoder clock (DCLK). The decoder requires an oscillator with a frequency 16x or 32x the bit rate. The HD-6409's speed selector (SS) pin (17) sets this, with SS low producing a 16x clock and SS high a 32x clock. We use the 32x mode, so the frequency of the free-running oscillator should therefore be 21292.8kHz for clock synchronisation with the incoming data (665.4kHz x 32 = 21292.8kHz). A frequency counter connected to the clock output (DCLK) via a 1kΩ resistor is very useful in showing when the internal clock is locked to the incoming data rate (665.4kHz) (Doppler shift causes the clock to shift over 30Hz between AOS and LOS.)

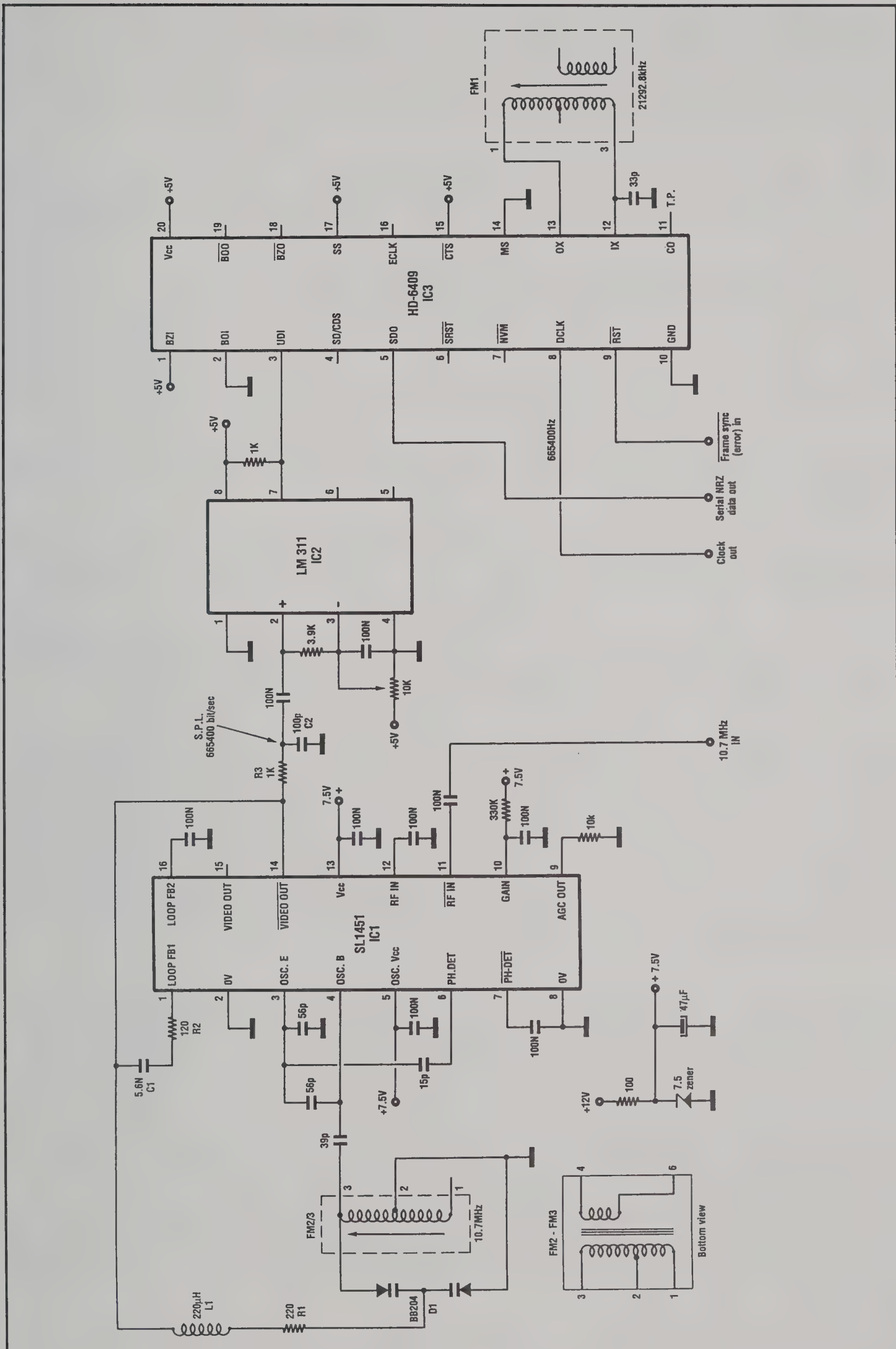


Fig. 3. The phase demodulator and split-phase-low to nonreturn-to-zero decoder

IC3's reset ($\overline{\mathrm{RST}}$) pin provides control of the decoder outputs. When $\overline{\mathrm{RST}}$ is low, SDO and DCLK are forced low. $\overline{\mathrm{RST}}$ is connected to the error detector in order to resolve the ambiguity problem. If $\overline{\text{frame sync}}$ is detected by IC10-12, the clock error generated is fed to $\overline{\mathrm{RST}}$ so that the phase of the clock is changed by 180 degrees.

IC3's $\overline{\mathrm{RST}}$ input is normally kept high by IC12. If you test this circuit subsection without connecting it to the following section (Fig 4), temporarily tie $\overline{\mathrm{RST}}$ high.

Serial-to-Parallel Converter, Frame Sync and Error Detector

See Fig 4. This section:

a) Performs the serial-to-parallel conversion.

b) Generates the $\overline{\text{frame sync}}$ (line start) at the last bit of the 60-bit sequence transmitted at the beginning of each line.

c) Generates the $\overline{\text{frame sync}}$ (error) at the last bit of the 60-bit sequence if it detects a phase error (that is, if the value of the bits is inverted).

d) Feeds the parallel data into the DMA computer interface (Fig 6) subdivided into bytes corresponding to the data words.

The serial-to-parallel conversion is performed by passing the serial data through a 24-bit shift register (IC4-6). Our system makes use of the eight most significant bits of the 10-bit word. The eight data lines are derived from the last six outputs of the first register (IC4, a 74164) and the first two of the second shift register (IC5, another 74164). The bus is fed into a D-type register (IC13, a 74374) that is clocked by the word strobe (a high at the end of each word). The eight parallel lines are connected to the DMA computer interface.

Only the last 24 bits of the 60-bit frame sync sequence transmitted at the beginning of each frame (line) are detected. When the 24th bit enters the first register (IC4), a low (frame sync flag) is generated at pin 19 of IC9 (a 74688); this is the line start flag.

This section also detects the inverted sequence in order to resolve the ambiguity problem. The effect of a phase error is that the data appears inverted (0 instead of 1 and vice versa). This situation is detected by checking the serial data for frame sync as well as $\overline{\text{frame sync}}$ and correcting the clock if $\overline{\text{frame sync}}$ is found. This signal, generated at pin 19 of IC12 (another 74688), is fed into the $\overline{\mathrm{RST}}$ input of the HD-6409 decoder (IC3).

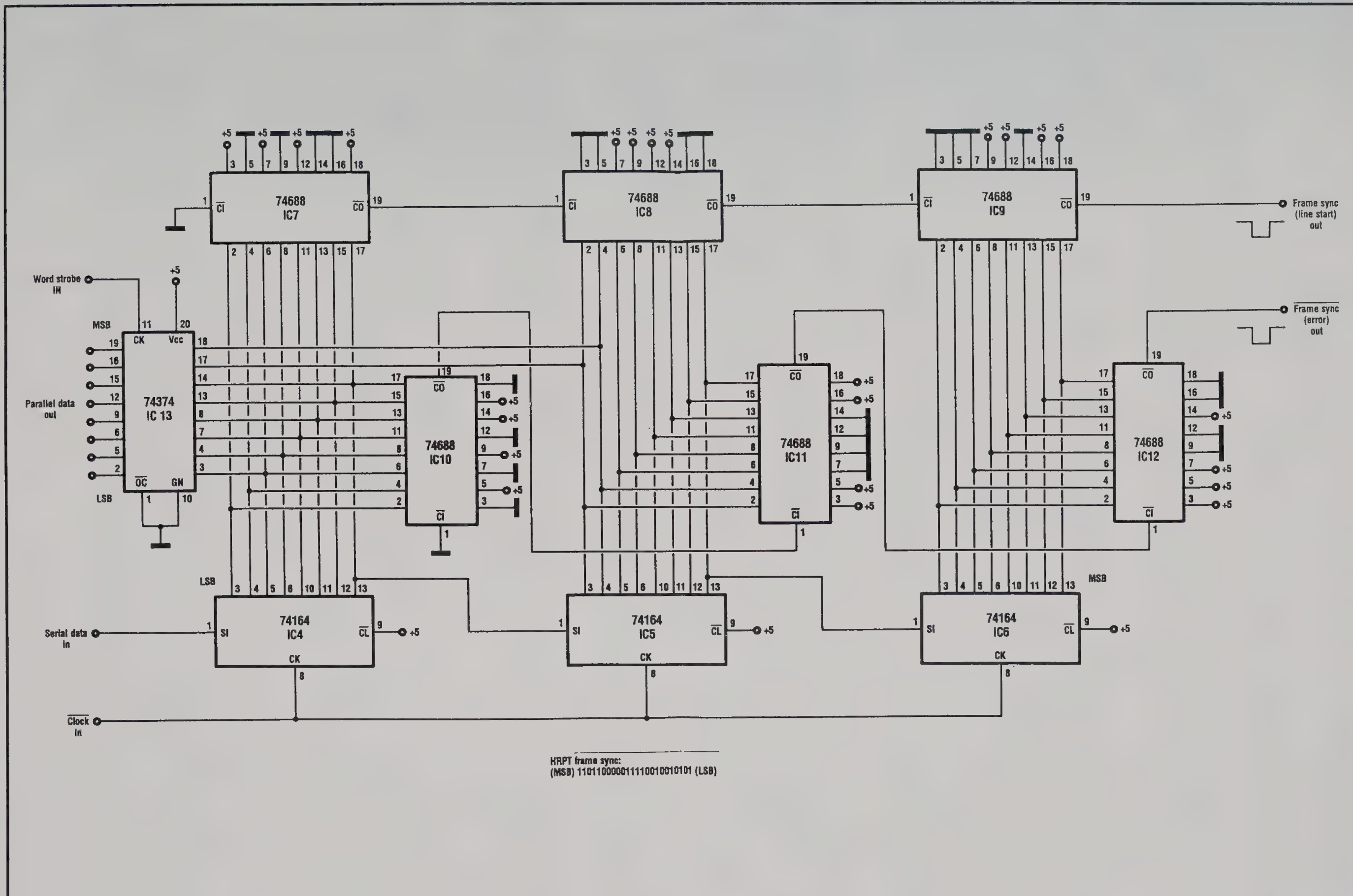


Fig. 4. The serial to parallel converter, frame sync and error detector

Word Strobe Detector

See Fig 5. This section performs these functions:

a) It divides the flow of clock pulses into blocks of 10 bits that correspond to the bytes or words of data, and provides a pulse (word strobe) at the last (tenth) bit of each word.

b) It divides the word strobe by 5 (in IC18, a 4017) so that you can chose one of the five channels transmitted by the satellite. IC18's five output lines carry the data of five multiplexed channels, each of which represents a view of the same area of the Earth as viewed by five bands of the light spectrum. A front-panel-mounted BCD switch selects the channel outputted by IC19, a 74151. (It's often practical to chose one channel and ignore the other four. This allows you to display a real-time image and avoids filling up your hard disk with data you won't use.)

c) It supplies the computer with the data of all the five channels if the divide by 5 (IC18) is bypassed. This option is implemented by the BCD switch. Storing five channels implies the creation of a *50 Mbyte* file for a 15 minute pass, which is not always feasible. Moreover, after a pass it is necessary to explode the five channels, an operation which requires another 50 Mbytes of hard-disk space.

d) It blocks the data not belonging to the images that are present on the line, ie, the first 750 bytes and the last 100 bytes of the frame.

e) It signals with D2, a front-panel-mounted LED, that the system recognizes the frame sync (line start); that is, the repetitive sequence situated at the beginning of each frame (line).

When the frame sync pulse (line start) is fed into the IC15A's CK input, Q goes high and therefore the clock pulses pass through IC16B and reach IC17, which divides the frequency by 10 thus generating the word strobe (66.54kHz) - a pulse at the end of each 10-bit word. The word strobe:

1) Drives IC13 of Fig4 to signal that the 8 bits present at its output are an image word.

2) Drives the DMA computer interface (via IC19 and IC16C) if you want to acquire all 5 channels. If you want to receive only one channel, IC18 divides the word strobe by 5, generating the sample strobe - a pulse that occurs every 50 bits, at the end of all the words of one of the five multiplexed channels. The desired channel can be selected by means of the BCD switch.

3) Drives counters IC20-23, the outputs of which are connected to the inputs of both

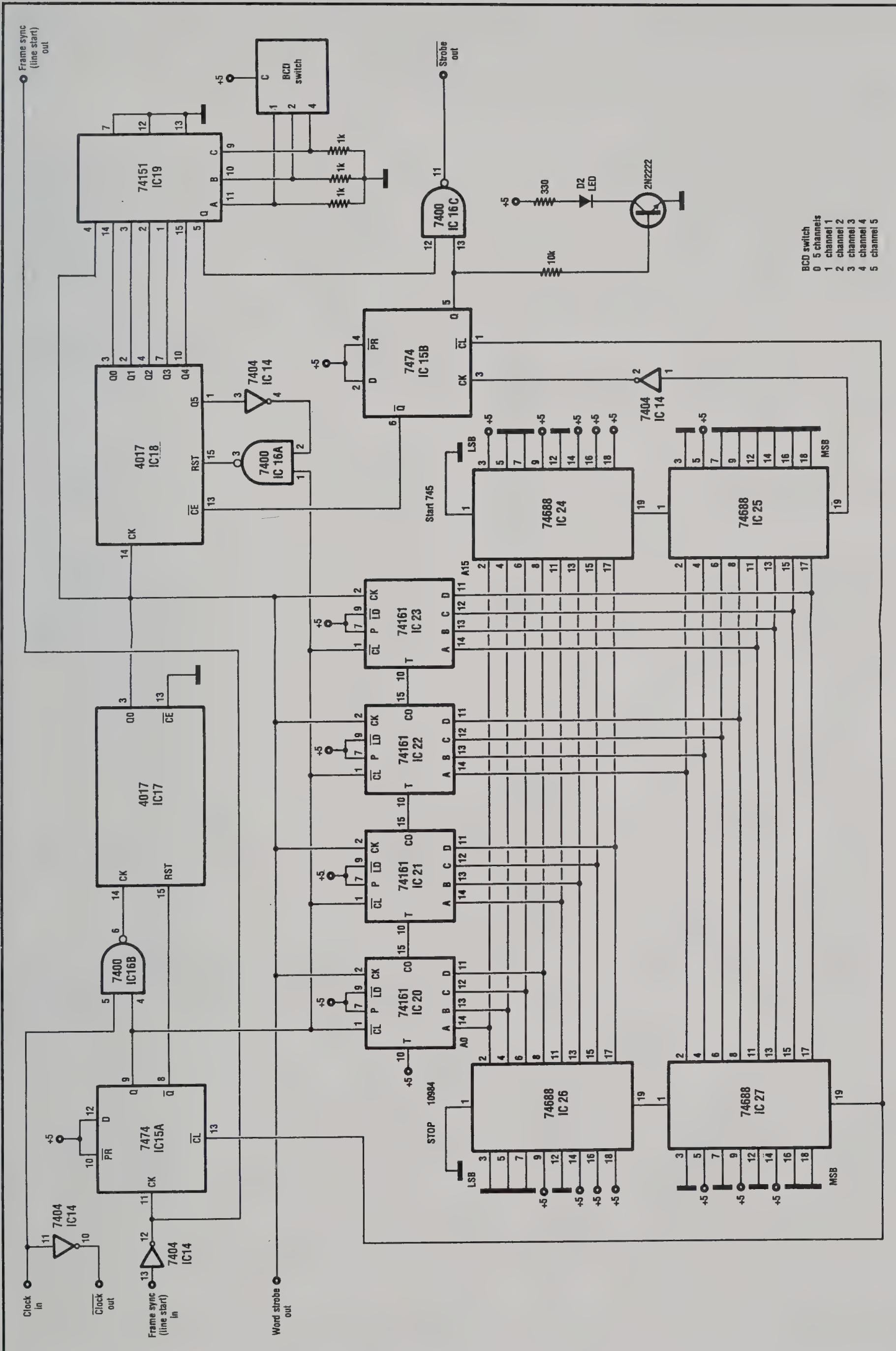


Fig. 5. The word strobe detector

the start comparators (IC26-27). The start pulse (a low at pin 19 of IC25) is generated at word 745 of the line (the first word of earth data is 751 minus 6 frame sync words); the stop pulse (a low at pin 19 of IC27) is generated at word 10984 (the last word of earth data is 10990 minus 6 frame sync words).

When the start signal is applied to IC15B's clock input, Q goes high, IC16C allows the strobe to pass, and LED D2 blinks 6 times per second, signalling that the system works. At the same time, $\overline{Q}$ goes low, thus enabling divide-by-5 IC18. IC18 is reset after the fifth count. The stop signal resets both flip-flops IC15A and B, and, via outputs Q and $\overline{Q}$ of IC15A, the counters and the dividers.

Frame sync and strobe are sent to the direct memory access (DMA) computer interface by means of separate shielded cables.

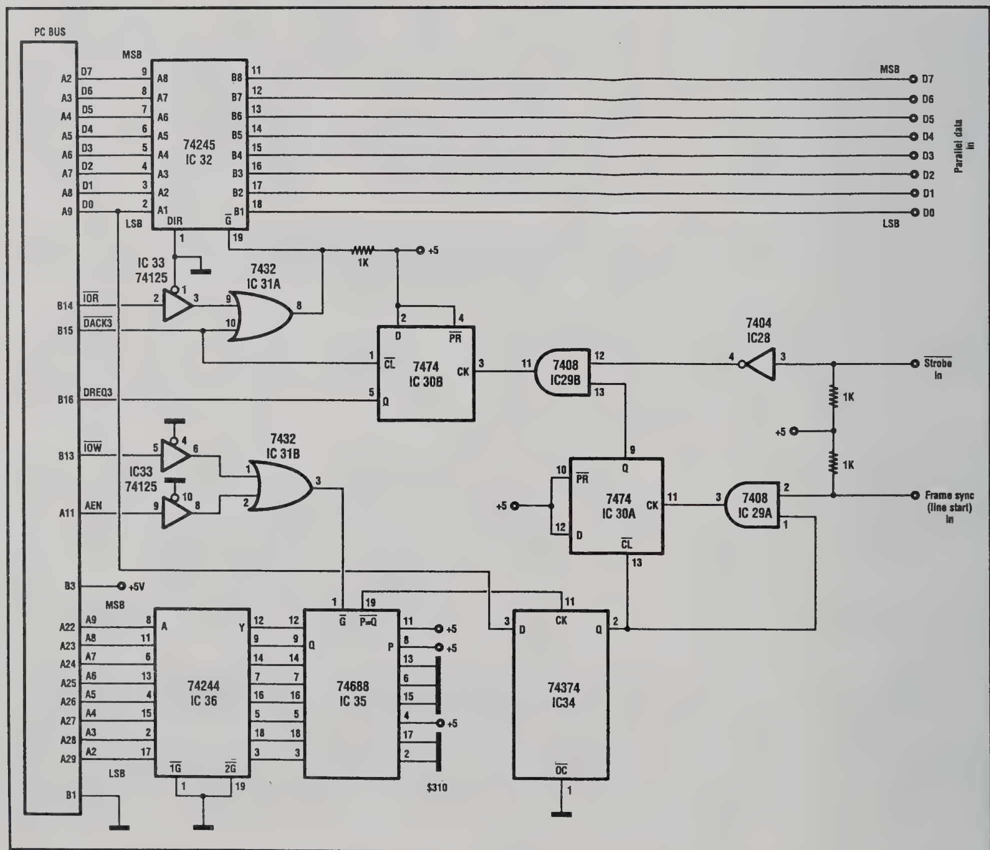


Fig. 6. The DMA interface

Function	Number of Words	Word Position	Word Code & Meaning MSB LSB
Frame sync	6	1	1010000100
		2	0101101111
		3	1101011100
		4	0110011101
		5	1000001111
		6	0010010101
Telemetry, TIP, etc	744	7 to 750	
Earth data	10240	751	Ch1 - Sample 1
		752	Ch2 - Sample 1
		753	Ch3 - Sample 1
		754	Ch4 - Sample 1
		755	Ch5 - Sample 1
		756	Ch1 - Sample 2
		757	Ch2 - Sample 2
		758	Ch3 - Sample 2
		759	Ch4 - Sample 2
		760	Ch5 - Sample 2
		761	Ch1 - Sample 3
		-	-
		-	-
		10985	Ch5 - Sample 2047
		10986	Ch1 - Sample 2048
		10987	Ch2 - Sample 2048
		10988	Ch3 - Sample 2048
		10989	Ch4 - Sample 2048
		10990	Ch5 - Sample 2048
Auxiliary sync	100	10991 to 11090	

Table 2 - HRPT Line Format

DMA Computer Interface

See Fig 6. This board, which installs in an expansion slot on the PC system board, performs these functions:

a) It activates the data input when requested by the receive software; then it resets the the DMA request.

b) It recognizes the line start pulse generated by IC9.

c) It makes a direct memory access request for the PC whenever a data item is acquired.

The three buffers IC32, IC33 and IC36 isolate the PC bus from the rest of the board. IC32 feeds the data into the PC bus. IC35 acts memory address decode logic (310_{16}). IC34 is a software-driven switch.

When the software keeps output Q of IC34 (pin2) high, the line-start signal is applied to IC30A which, in turn, activates IC29B. Under this condition, the strobe signal reaches IC30B, whose output Q (pin 5) generates a Dma REQuest (DREQ). Then the computer responds by activating the Dma ACKnowledge (DACK) line, which resets IC30B and enables IC32 to feed data (D0-D7) into the data bus.

PC

Our computer is a 486DX, 33MHz machine with 4 Mbytes of RAM. The hard disk is a 340 Mbytes Western Digital with a VESA controller; it has 15ms access time. The video adapter card is a Cirrus 5428 with 1 Mbyte of memory. Slower machines may not be able to perform all the options of the program (eg, storing 5 channels, displaying and storing at the same time), but they should be able to do all the basic functions.

Software

We use *Turbo Pascal* as our programming tool. The program, produced by Giampaolo, IW4CSG, covers HRPT as well as APT/WEFAX and HR (digital) Meteosat, but this article does not deal with the hardware interfaces necessary for the latter. The pictures can be displayed in various formats, stored on disk and processed (zoomed, enhanced and cleaned if single pixelsor lines have gotten lost because of noise).

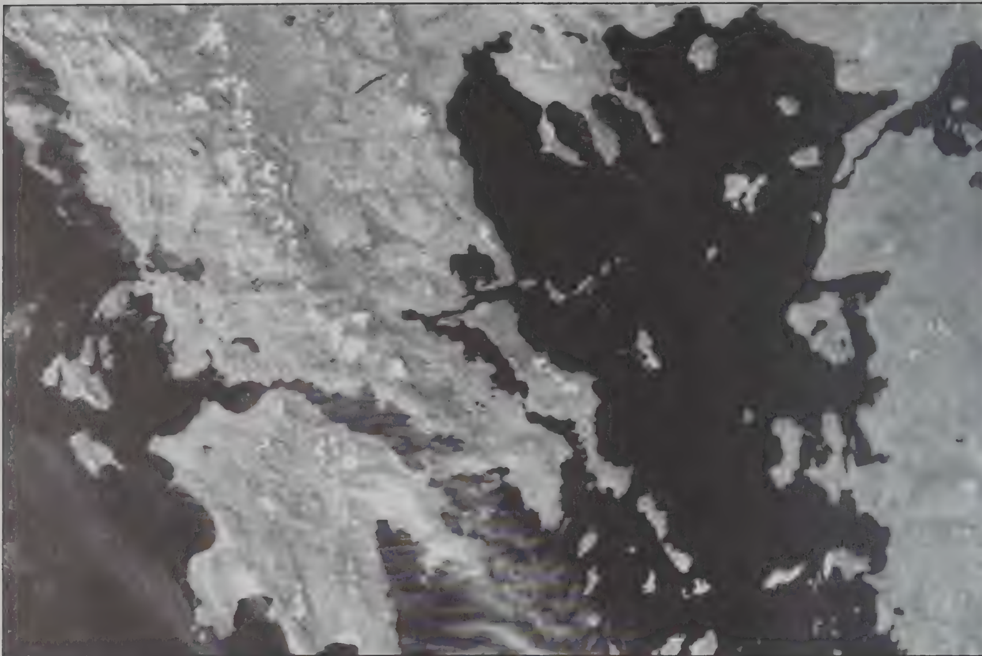
The software is free, is not copy-protected and can be downloaded as METEO.ZIP from the ARRL BBS at 860-594-0306 and meteo.zip from the *QEX* FTP site (ftp://arrl.org/pub/qex/). *[The latest English version of this software is called HAMVIEW.ZIP and is available from the RIG BBS - Ed]*

The Pictures

[It was not possible to satisfactorily reproduce the images which appeared in the QEX article but Marciano has made other images, produced with the same equipment, available for the RIG GIF library and a few are reproduced here. Ed.]

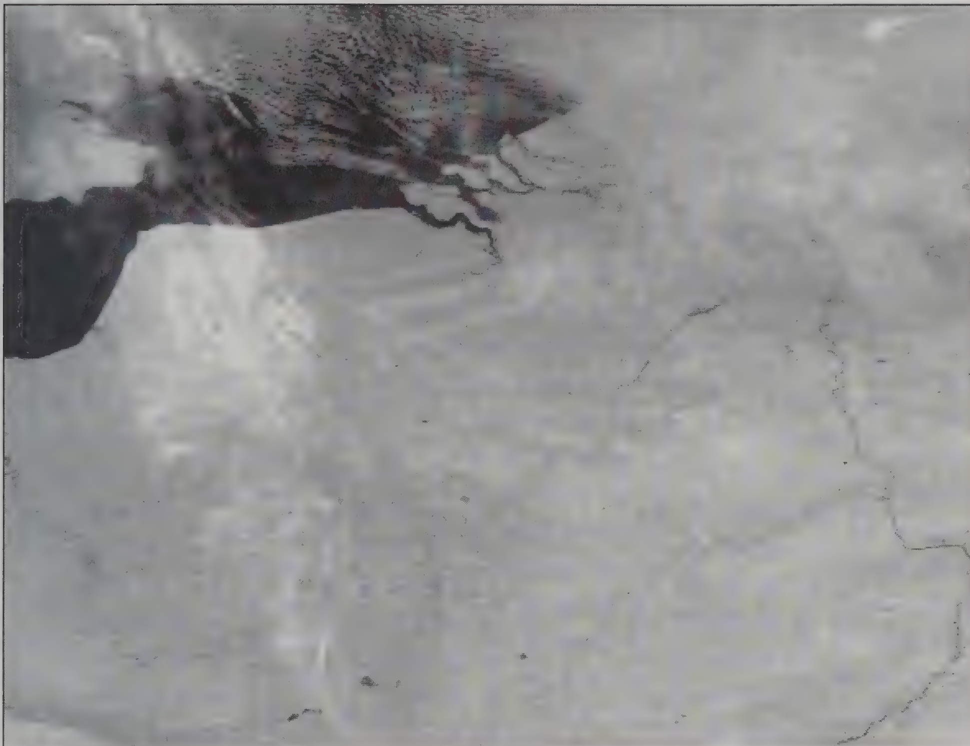
Northern Italy in afternoon sunshine

Paris and the River Seine are conspicuous in this image



Greece and western Turkey almost cloud-free

The Danube separates Romania in the north from Bulgaria and Serbia



Warm rivers in Germany contrast with the cold land in this IR image

Glossary

AOS- Acquisition of Signal

APT- Automatic Picture Transmission. Analog system for the transmission of environmental images used by the NOAA weather satellites. The APT signal derived from the AVHRR (see below) consists of a multiplexed output of two selected channels of this instrument. The APT signal modulates a 2400Hz subcarrier, which is then frequency-modulated on a VHF RF carrier and transmitted to ground stations.

AVHRR- Advanced Very High Resolution Radiometer. The instrument, which scans the Earth's surface by means of a rotating mirror, is sensitive in five spectral regions. The scan of the AVHRR is converted to a digital format, which is then phase-modulated on an S-band carrier and transmitted to ground stations.

Frame- Major frame corresponds to three successive lines during which the same TIP (TIROS Information Processor) data is transmitted. Minor frame means single line. In this article, the word *frame* is used with the meaning of scan line. The HRPT

frame is 6 per second. In a frame there are 11090 10-bit words.

Frame sync- A sequence of 60 bits (six words) at the beginning of each frame. In this article, *frame sync* means also the line start pulse generated at the 60th bit of the sequence.

HRPT- High Resolution Picture Transmission. Digital system for the transmission of environmental images generated by the AVHRR. The HRPT is provided in a split-phase format to the S-band transmitter.

LOS- Loss of Signal

NRZ- Nonreturn-to-Zero. A code representing the binary values (logic 0 and logic 1) with a static level maintained throughout the data cell. Consequently, there is no transition between two successive bits of the same binary value.

Sample strobe- Word strobe divided by 5; therefore a pulse at the end of all the words of one of the 5 multiplexed images.

Split-Phase-Low- Also known as Biphase-Low or Biphase Manchester code, represents data with a level transition in the middle of the data cells. The direction of the transition indicates the binary value of the data. A logic 0 is defined as a low-to-high transition in the middle of the data cell, and a logic 1 as a high-to-low mid-bit transition. In Manchester, the serial data stream contains both the clock and the data, with the position of the mid-bit transition representing the clock and the direction of the transition representing data. Therefore, there is no phase variation between the clock and the data.

Word strobe- A pulse generated at the last bit of each word.

Reference: [1] GEC Plessey Semiconductors, "Designing with the SL - 1451 Phase Locked Loop," *Consumer IC Handbook*, Sep 1991, pp8-23 to 8-25. ⊕

GALILEO UPDATE

A further analysis of the data returned by the Galileo probe during its descent through the upper Jovian atmosphere has shown that some of the early findings reported in the last issue of RIG Journal were incorrect. In fact, the composition was found to be much nearer to what was predicted. Most significantly, the hydrogen/helium ratio now closely matches that of the Sun suggesting that the bulk composition of Jupiter is virtually unchanged since its formation over 4 billion years ago. All the probe data have now been successfully returned to Earth and the first images of Jupiter should be available soon. ⊕

ANTENNA MODELLING WITH NEC
John Boyer G0WRX

What is NEC?

NEC stands for Numerical Electromagnetic Code. Which, more simply, means an antenna modelling program. The original version of NEC was developed for the US Navy at the Lawrence Livermore Laboratories in 1981. There are newer versions of NEC such as NEC3 and NEC4. As I understand it, NEC3 is 'buggy' and the differences between it and NEC2 are small. NEC4 is the 'bees knees', and will handle buried wires and complicated grounds, but is only available by spending something in the region of 1000 US dollars or, if you are outside the US by applying via your embassy. However, the good news is that NEC2 is freeware. I am really writing about NEC2 as it's the only version that I have any experience of and hereafter I refer to it as NEC.

In NEC you can define wires in 3D space. These wires are split up into segments and, as a general rule of thumb, you need a minimum of 10 segments per wavelength. You can excite those wires either with a plane wave or with a voltage source on any segment. You can do a frequency sweep, measure the horizonal radiation pattern, the vertical radiation pattern or both. That means you can measure the pattern either around the aerial or up and over, as opposed to the horizontally polarised horizontal radiation pattern, which means you find the horizontal component of the pattern of the aerial. You can model transmission lines between segments or load segments with a complex impedance. It even makes the coffee. Actually it doesn't. When you get a reasonable sized model NEC can, even on a decent machine, take quite some time. If you are running on a PC, you must have a maths coprocessor. So, go and make that cup of coffee.

How do I get it?

NEC is available on the net. The best place to start is the ACES homepage http://www.emclab.umr.edu/aces/. ACES is the Applied Computational Electromagnetics Society and they have compilations of NEC for various platforms as well as useful utilities for helping create NEC input files and viewing the results. Another very handy place to visit is http://www.cici.com/~richesop/nec/index.html. This site holds an online hypertext manual. So even if you don't understand this brilliant article there are other places for further information. The utilities are worth picking up. A major difficulty with NEC is spotting mistakes in the input file. There are a couple of programs that can help. One is a structure viewing program that uses the input file for its source. The other uses the NEC output file. Both are equally valid. I have had antennas where an element has gone flying off at the wrong angle and looks about 100 times too long. All because of a typo. I wouldn't have been able to spot where the problem was without this sort of utility.

What machines are required?

NEC sounds wonderful; all singing and dancing but there is a little problem. NEC is very maths intensive. If you have not got a maths coprocessor then don't bother with NEC as it will take a million years just to run very simple models. That means all you folk with 486SXs can forget it. You can run NEC on a UNIX machine or a Linux machine and even SGIs. You need a decent amount of memory as NEC generates huge matrices, which it then has to solve. As a rough guide you need 8 times the number of segments squared, plus a bit for NEC itself. Once your machine starts paging out to disk you are on a slippery slope to a long wait. If I remember rightly, some of the PC versions of NEC have been compiled for use with certain DOS extenders, but smart cookies could always compile their own. As a timing guide my 486 DX50 running Linux took 52 seconds to run this small example model, and 4.6 seconds on a 75MHz Super Sparc!!

How do I use it?

The easiest way to explain how to use NEC is to go through an example but, before that, it is important to get a feel for the coordinate system that NEC uses. The coordinates are of course in x,y and z dimensions. Try and imagine x is North, y is East, and z is up. That makes -x South, -y West and -z down. All dimensions are in meters unless the SC (scale) card is used. I never bother with it, as it just confuses me. Here is a model of an 8-element 432MHz Yagi. The NEC input files are in a card image format that must be adhered to.

```
CM These are comment cards and must be followed
CM by a CE card (comment end)
CEGW1,25,0.,-.17,0.,0.,.17,0.,.0008,
GW2,25,.104,-.167,0.,.104,.167,0.,.0008,
GW3,25,.146,-.1575,.0,.146,.1575,0.,.0008,
GW4,25,.224,-.153,0.,.224,.153,0.,.0008,
GW5,25,.332,-.1495,0.,.332,.1495,0.,.0008,
GW6,25,.466,-.1475,0.,.466,.1475,0.,.0008,
GW7,25,.622,-.1455,0.,.622,.1455,0.,.0008,
GW8,25,.798,-.1445,0.,.798,.1445,0.,.0008,
GW9,25,.99,-.1435,0.,.99,.1435,0.,.0008,
GW10,25,1.196,-.1425,0.,1.196,.1425,0.,.0008,
GE0,0,0.,
EX0,2,13,00,1.,0.,
FR0,1,0,0,432.,0.,0.,
RP0,1,360,1010,90.,0.,0.,1.,0.,0.,
EN
```

After the CE card, the next line is our first wire. The most commonly used card is the GW card. This stands for General Wire (wasn't he some guy in the British Army?).

Each wire has a tag number (its identity), then we have the number of segments that the wire is to be divided into when the structure is put into NEC. Don't forget a minimum of 10 segments per wavelength, and wires should only meet/cross at a segment end, which is not necessarily a wire end. Use more segments where you expect large currents, like in the driven element of a Yagi.

Now the fun begins. The rest of the card is made up of the x,y and z coordinates of the start of the wire. The x,y and z coordinates of the end of the wire and the radius of the wire. Let's take the first GW card this wire (number 1) comprises 25 segments and is .34m long. It extends .17m West and .17m East; x and z are 0. The wire .0016m thick (1.6mm or approx 1/16 inch). The next wire you can see is slightly shorter and is positioned .104m northwards, and so on until the Yagi is completed.

The section of the model that describes the geometry is terminated with the GE card (Geometry End), the numbers following the GE card do have a meaning, but for general use keep them as they are. You could use them to include a real ground in the model.

Now we get to the really exciting bit; the EX card (Excitation). This is where we can drive elements and select feed points, the amplitude of the voltage we will feed them with and even the phase of the voltage applied. Take EX0 as a standard; you can use other figures, but these are for doing clever things such as exciting a structure with a plane wave. The next figure (2) is the tag number of the wire to be driven. That's handy it appears to be wire number 2 (our driven element). After that you have the segment of that wire which is to be driven. The 13th segment of wire number 2 is in the middle. Leave the next number as 00. Next is the relative amplitude of the applied voltage and after that, the relative phase of that voltage. I say relative because should you want to do something more complex, such as a quadrafilar helix, you can feed the individual elements as you wish.

The FR card, as you may have guessed, contains the frequency the aerial will be tested at. The only number of interest to most is the 432 in the middle. Change that to whatever frequency your aerial is supposed to work on.

We need to get a radiation pattern out of NEC. The RP card (Radiation Pattern) determines which radiation pattern we measure. Use RP0, then the number of angles to measure in the vertical plane (elevation, 0 degrees being straight up), the number of angles to measure in the horizontal plane (azimuth, 0 degrees being 'North'). Ignore the complicated 1010 bit. Then we have starting elevation, starting azimuth, elevation step (in this case 0), azimuth step, and leave the next two as they are. The EN card is easy. It means 'The End'.

Once you have done this, then you need to run NEC and after a length of time,

which is dependent on the speed of your machine, you will end up with a NEC output file.

The NEC output file

The NEC output file is rather lengthy. It starts off by echoing the structure as described in the input file. Then it gives the start and stop coordinates and the angles relative to the axes for every single segment. This is followed by some information on the output cards, structure loading, and environment (for example, is there a ground?). There is information on the excited segments from which you can work out the match of the aerial. Next is a table of the currents in all the segments. This is very useful when looking for hot spots in an aerial design. Finally, we have the really useful bit, the radiation pattern. In this table we get the horizontal field and the vertical field. We get information about the azimuth and elevation so we could do a 3D radiation pattern if we wanted to. We even get a relative gain figure (in dBi) at each bearing. Remember that the maximum figure is the gain w.r.t an isotropic radiator. So for this 432Mhz Yagi the gain is 11.97dBi or 9.8dBd. Assuming no losses for matching networks. The radiation pattern taken from this output file is shown in Figure 1.

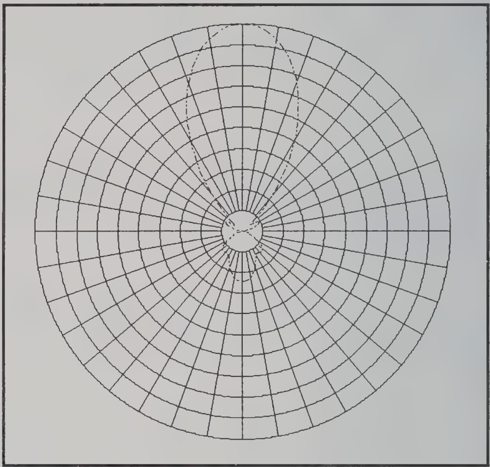


Fig. 1

Other cards

Other cards enable the user to reflect structure about a particular plane or load segments with a complex impedance and even add transmission lines, which must connect two segments. That is very useful for log-periodic aerials. A very handy card is the GM card (General Move). You can use this to move a wire either by rotating it about any axis or by rotation and copying it or just a offset in any direction copying or not copying as you wish. This is how I produce a mesh. When making meshes and the like, be-

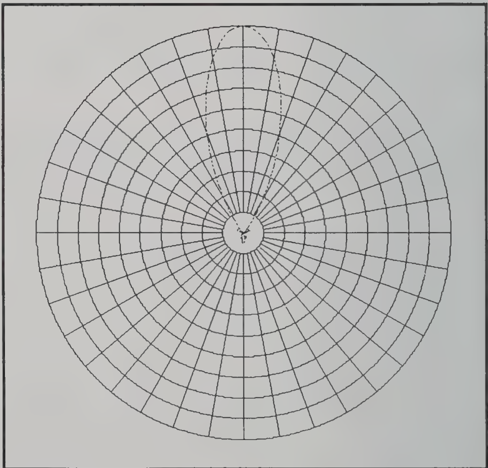


Fig. 2

ware that wires can only cross at segment ends.

If we were to use the GW card to add another Yagi to our model to form an array of two Yagis to increase our gain we could use the GM card. The GM card goes like this; GM, tag number increment, number of new structures, rotation in degrees about x axis, same for y, and z, translation in x, same for y and z, and finally the wire to start translating from. This means that if you put a 0 here then the whole structure is moved or copied. If you use 5 then every wire from 5 onwards is moved.

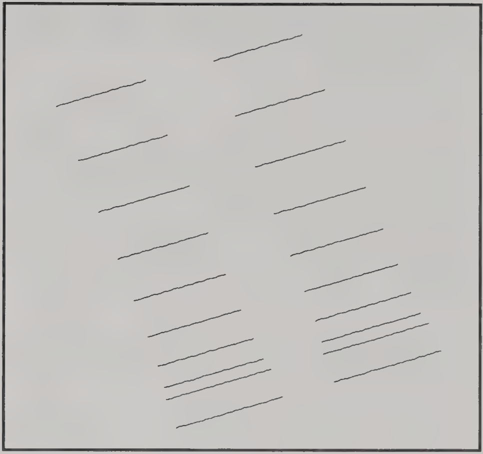


Fig. 3

In our two Yagi array we would just add the line GM11,1,0.,0.,0.,0.,.5,0.,0., this copies the whole Yagi .5m westwards. We also need to excite the driven element of the new Yagi so, below the existing EX card, we would add EX0,13,13,00,1.,0.,. The second driven element is 13 because the first was number 2 and 2+11=13! The pattern for our new improved array is shown in Figure 2, and Figure 3 shows the structure of the Yagi array.

That pretty much wraps it up. This just shows the elementary facilities of NEC, but even they are very powerful and can be used to model quite complicated aerials. ⊕

JVFAX VERSION 7.1

In the last issue, page 66, Les Hamilton indicated that the differences between versions 7.0 and 7.1 were small and suggested that users continue with 7.0. This has proved to have been good advice as problems have been encountered in version 7.1.

RIG member Andreas Lubnow, DL6AAS, has sent a translation of a PR message originated by Eberhard Backeshoff, DK8JV, the author of JVFAX. In it he says the September 1995 revision is faulty in that it does not recognize the automatic end-of-picture when receiving Meteosat transmissions. DK8JV claims that this bug is solved with the 951201 revision. However, this latest revision contains a minor bug in that an automated reception extending beyond midnight will reset the computer's date erroneously. It seems prudent to remain with version 7.0 for the time being although the latest revision of version 7.1 is available on the RIG BBS. ⊕

CONFIGURING JVFAX TO RECEIVE OKEAN AND SICH

Les Hamilton

Since my JVFAX guide appeared in RIG 44, I have had a number of enquiries on the subject of configuring the program for automatic capture of the Okean and Sich satellites. The NOAA and Meteor satellites are provided for with default squelch modes which analyse the incoming signals, and lock on to the tone-burst at the start of each image line. These tone-bursts appear as the vertical white and black lines at the sides of satellite images. This facility is not built-in for the Okean and Sich series of orbiters.

Okean and Sich signals are complicated by the fact that there is no standard tone-burst. In some image transmissions, edge-codes alternate between numbers and a greyscale; in others, the familiar 'piano key' edge code is observed. Clearly neither of these provides a reliable source of reference for the software.

The solution is remarkably straightforward. Start up JVFAX, and once the main menu screen appears, press the <M> key to enter the Mode Editor screen. This presents a number of fields which require editing. In some instances this is achieved by deleting the existing contents; in others you must use the +/- keys on the numeric keypad to cycle through a set of preset values. 'Quite a number of the fields may be left unaltered. Here is a step-by-step guide to what you have to alter.

SICH 1 RADAR image. Gulf of Riga to Aegean Sea 9 Jan 1996 0138UT

PREDICTED TIMES (GMT) FOR AQUISITION OF SIGNAL FOR 52.5 DEG NORTH, ZERO DEG EAST

	NOAA 12				NOAA 14				OKEAN 4				SICH 1			
	Period 101.28 mins				Period 102.07 mins				Period 97.75 mins				Period 97.78 mins			
	137.50MHz				137.62MHz				137.40MHz				137.40MHz			
	S'bound		N'bound		S'bound		N'bound		N'bound		S'bound		S'bound		N'bound	
10 Jun	0623	0803	1613	1751	0147	0328	1140	1320	1056	1235	2102	2241	0522	0700	1943	2120
11	0601	0741	1729	1910	0136	0317	1130	1309	0946	1122	1951	2129	0549	0727	2009	2148
12	0719	0900	1708	1847	0125	0306	1119	1258	1012	1149	2017	2155	0616	0754	1900	2036
13	0657	0838	1646	1825	0114	0255	1247	1429	1037	1216	2043	2222	0505	0642	1926	2103
14	0636	0816	1625	1803	0103	0244	1236	1418	0927	1104	1932	2110	0531	0710	1952	2131
15	0614	0754	1742	1923	0233	0414	1226	1407	0953	1130	1958	2136	0558	0736	1842	2019
16	0732	0913	1720	1901	0222	0404	1215	1356	0844	1018	2024	2203	0447	0625	1908	2046
17	0710	0851	1659	1838	0212	0353	1204	1345	0908	1045	1913	2051	0514	0652	1800	1935
18	0649	0829	1637	1816	0201	0342	1154	1334	0934	1111	1939	2117	0541	0719	1825	2001
19	0627	0807	1616	1754	0150	0331	1143	1323	0824	0959	2006	2144	0430	0608	1851	2029
20	0605	0745	1733	1914	0139	0320	1132	1312	0849	1026	1854	2032	0457	0635	1742	1917
21	0723	0904	1711	1851	0128	0309	1122	1301	0914	1053	1920	2059	0524	0702	1807	1944
22	0701	0842	1650	1829	0117	0258	1250	1432	0805	0940	1947	2125	0413	0551	1833	2012
23	0640	0820	1629	1807	0106	0247	1239	1421	0830	1007	1835	2013	0439	0618	1725	1900
24	0618	0758	1745	1927	0236	0417	1228	1410	0855	1034	1901	2040	0329	0506	1750	1927
25	0556	0736	1724	1904	0225	0406	1218	1359	0746	0922	1928	2106	0355	0533	1816	1954
26	0714	0854	1702	1842	0214	0355	1207	1348	0811	0948	1816	1954	0422	0600	1707	1843
27	0652	0833	1641	1820	0203	0344	1156	1336	0837	1015	1842	2021	0311	0449	1732	1910
28	0631	0811	1620	1758	0152	0334	1146	1326	0727	0903	1731	1909	0338	0516	1759	1937
29	0609	0749	1736	1917	0141	0322	1135	1314	0752	0929	1757	1935	0405	0543	1649	1825
30	0727	0907	1715	1855	0131	0312	1124	1304	0818	0956	1823	2002	0254	0432	1715	1852
01 Jul	0705	0845	1653	1833	0120	0301	1253	1435	0708	0844	1712	1850	0320	0459	1741	1920

	NOAA 12				NOAA 14				OKEAN 4				SICH 1			
	S'bound		N'bound		S'bound		N'bound		N'bound		S'bound		S'bound		N'bound	
02 Jul	0643	0823	1632	1811	0109	0250	1242	1424	0733	0910	1738	1916	0347	0526	1632	1808
03	0621	0801	1749	1931	0239	0420	1231	1413	0759	0937	1804	1943	0236	0414	1657	1835
04	0600	0740	1727	1908	0228	0409	1220	1401	0649	0825	1653	1831	0303	0441	1549	1723
05	0718	0858	1706	1846	0217	0358	1210	1350	0714	0851	1719	1857	0330	0508	1614	1751
06	0656	0836	1644	1823	0206	0347	1159	1339	0740	0918	1745	1923	0219	0357	1640	1818
07	0634	0814	1623	1802	0155	0336	1148	1328	0629	0806	1634	1812	0245	0424	1531	1706
08	0612	0752	1740	1921	0144	0325	1138	1318	0655	0832	1700	1838	0313	0451	1557	1733
09	0730	0911	1718	1859	0134	0314	1127	1306	0721	0859	1726	1905	0202	0340	1622	1800
10	0709	0849	1657	1837	0123	0303	1117	1255	0610	0747	1615	1753	0228	0407	1514	1649
11	0647	0827	1636	1814	0112	0253	1245	1427	0635	0813	1641	1819	0118	0255	1539	1716
12	0625	0805	1614	1753	0101	0242	1234	1415	0527	0701	1707	1846	0144	0322	1605	1743
13	0603	0743	1731	1912	0231	0412	1223	1404	0551	0728	1556	1734	0211	0349	1456	1632
14	0721	0902	1709	1849	0220	0401	1212	1353	0617	0754	1622	1800	0100	0238	1521	1659
15	0700	0840	1648	1827	0209	0350	1202	1342	0507	0642	1648	1827	0127	0305	1547	1726
16	0638	0818	1627	1805	0158	0339	1151	1331	0532	0708	1537	1715	0153	0332	1438	1614
17	0616	0756	1605	1743	0147	0328	1140	1320	0557	0735	1603	1741	0043	0220	1504	1641
18	0554	0734	1722	1902	0136	0317	1130	1309	0448	0623	1452	1629	0109	0248	1355	1530
19	0712	0853	1700	1840	0125	0306	1119	1258	0513	0650	1518	1656	0136	0315	1421	1557
20	0650	0831	1639	1818	0114	0255	1247	1429	0538	0717	1544	1722	0025	0203	1446	1624
21	0628	0809	1618	1756	0104	0244	1237	1418	0429	0604	1432	1611	0052	0230	1338	1513
22	0607	0747	1734	1915	0233	0415	1226	1407	0454	0631	1459	1637	0119	0258	1403	1539
23	0725	0905	1713	1853	0222	0404	1215	1356	0519	0658	1525	1704	0008	0146	1429	1607
24	0703	0843	1651	1831	0211	0353	1204	1345	0410	0545	1414	1552	0034	0213	1320	1455
25	0641	0821	1630	1809	0201	0342	1154	1334	0435	0612	1440	1618	0101	2350	1345	1522
26	0619	0759	1747	1929	0150	0331	1143	1323	0500	0639	1506	1645	0128	0307	1411	1549
27	0557	0738	1725	1906	0139	0320	1132	1312	0351	0526	1355	1533	0017	0155	1438	1617

	NOAA 12				NOAA 14				OKEAN 4				SICH 1			
	S'bound		N'bound		S'bound		N'bound		N'bound		S'bound		S'bound		N'bound	
28 Jul	0536	0716	1703	1844	0128	0309	1122	1301	0416	0553	1421	1559	0044	2333	1327	1505
29	0654	0834	1642	1822	0117	0258	1250	1432	0307	0441	1447	1626	0111	2400	1354	1532
30	0632	0812	1621	1800	0106	0247	1239	1421	0332	0508	1336	1514	0138	2249	1245	1420
31	0610	0750	1738	1919	0236	0417	1228	1410	0357	0534	1402	1540	0027	2315	1310	1448
01 Aug	0729	0909	1716	1857	0225	0406	1218	1359	0248	0422	1428	1606	0054	2342	1336	1514
02	0707	0847	1655	1835	0214	0355	1207	1348	0312	0448	1317	1455	2231	2409	1227	1403
03	0645	0825	1634	1812	0203	0344	1156	1336	0338	0515	1343	1521	2258	2436	1253	1430
04	0623	0803	1751	1932	0152	0333	1146	1326	0228	0403	1409	1548	2148	2325	1319	1457
05	0601	0741	1729	1910	0142	0323	1135	1315	0253	0429	1258	1436	2214	2352	1209	1346
06	0719	0900	1707	1847	0131	0312	1124	1304	0319	0456	1324	1502	2241	2419	1235	1413
07	0657	0838	1646	1825	0120	0301	1253	1435	0209	0344	1350	1529	2308	2446	1127	1302
08	0636	0816	1625	1803	0109	0250	1242	1424	0234	0410	1239	1417	2157	2335	1152	1328
09	0614	0754	1741	1923	0239	0420	1231	1413	0259	0437	1305	1443	2223	2402	1218	1356
10	0732	0912	1720	1900	0228	0409	1220	1401	0150	0325	1154	1331	2251	2429	1109	1244
11	0710	0850	1658	1838	0217	0358	1209	1350	0215	0352	1220	1358	2140	2318	1135	1311
12	0648	0829	1637	1816	0206	0347	1159	1339	0240	0418	1246	1424	2206	2345	1200	1338
13	0626	0807	1616	1754	0155	0336	1148	1328	0131	0306	1135	1313	2056	2233	1052	1227
14	0605	0745	1732	1913	0144	0325	1138	1317	0156	0333	1201	1339	2122	2300	1117	1253
15	0723	0903	1711	1851	0133	0314	1127	1306	0221	0359	1227	1406	2149	2327	1143	1321
16	0701	0841	1649	1829	0122	0303	1256	1438	0112	0247	1116	1254	2038	2216	1034	1210
17	0639	0819	1628	1807	0112	0252	1245	1427	0137	0314	1142	1320	2105	2243	1100	1237
18	0617	0757	1745	1926	0241	0423	1234	1415	0202	0340	1208	1347	2131	2310	1126	1303
19	0555	0735	1723	1904	0231	0412	1223	1404	0053	0228	1057	1235	2021	2159	1010	1152
20	0713	0854	1702	1842	0220	0401	1212	1353	0118	0255	1123	1301	2048	2226	1042	1219
21	0651	0832	1640	1820	0209	0350	1202	1342	0143	0321	1149	1328	2114	2253	1108	1247
22	0630	0810	1619	1758	0158	0339	1151	1331	0033	0209	1038	1216	2004	2141	0959	1134

	NOAA 12				NOAA 14				OKEAN 4				SICH 1			
	S'bound		N'bound		S'bound		N'bound		N'bound		S'bound		S'bound		N'bound	
23 Aug	0608	0748	1736	1917	0147	0328	1140	1320	0059	0236	1104	1242	2030	2208	1024	1202
24	0726	0907	1714	1855	0136	0317	1130	1309	0124	0303	1130	1309	2057	2236	0916	1051
25	0704	0845	1653	1832	0125	0306	1119	1258	0014	0150	1019	1157	1946	2124	0941	1117
26	0643	0823	1632	1810	0114	0255	1247	1429	0039	2331	1045	1223	2013	2151	1007	1145
27	0621	0801	1748	1930	0104	0244	1236	1418	0105	2355	1111	1250	2040	2218	0859	1033
28	0559	0739	1727	1908	0233	0414	1226	1407	0131	0311	1000	1137	1929	2107	0924	1100
29	0717	0858	1705	1845	0222	0403	1215	1356	0020	2311	1026	1204	1956	2134	0950	1127
30	0655	0835	1644	1823	0212	0353	1204	1345	0046	2336	1052	1231	2023	2201	0841	1016
31	0633	0814	1622	1801	0201	0342	1154	1334	0112	2401	0941	1119	1911	2049	0906	1043
01 Sep	0612	0752	1739	1921	0150	0331	1143	1323	0139	2252	1007	1145	1938	2117	0932	1110
02	0730	0910	1718	1858	0139	0320	1132	1312	0027	2317	1033	1212	2005	2143	0823	0959
03	0708	0848	1656	1836	0128	0309	1122	1301	0053	2342	0921	1100	1854	2032	0849	1026
04	0646	0826	1635	1814	0117	0258	1250	1432	2233	2408	0948	1126	1921	2059	0915	1053
05	0624	0804	1614	1752	0106	0247	1239	1421	2257	2434	1014	1152	1810	1947	0806	0941
06	0602	0742	1730	1911	0236	0417	1228	1410	2150	2323	0903	1041	1837	2015	0831	1008
07	0721	0901	1709	1849	0225	0406	1218	1358	2213	2339	0929	1107	1903	2042	0857	1036
08	0659	0839	1647	1827	0214	0355	1207	1347	2238	2415	0955	1134	1753	1930	0748	0924
09	0637	0817	1626	1805	0203	0344	1156	1336	2304	2442	0843	1022	1819	1957	0814	0951
10	0615	0755	1743	1924	0152	0333	1145	1325	2154	2330	0910	1048	1846	2025	0840	1018
11	0553	0733	1721	1902	0141	0322	1135	1314	2219	2356	0758	0936	1735	1913	0730	0906
12	0711	0852	1659	1839	0131	0311	1124	1303	2245	2423	0825	1003	1802	1940	0756	0934
13	0649	0830	1638	1817	0120	0300	1253	1435	2135	2311	0851	1029	1829	2007	0648	0822
14	0628	0808	1617	1755	0109	0250	1242	1424	2200	2337	0740	0917	1718	1856	0713	0849
15	0606	0746	1734	1915	0239	0420	1231	1412	2226	2404	0806	0944	1745	1923	0739	0916
16	0724	0904	1712	1852	0227	0409	1220	1401	2116	2252	0832	1010	1811	1950	0630	0805
17	0702	0842	1651	1830	0216	0357	1209	1350	2141	2319	0721	0859	1700	1838	0655	0832

1. The cursor is initially in the Mode: field at top left of the screen. Use the +/- keys until an unallocated mode appears. I choose mode 10 which is the first to show. Next press <enter> and type OKEAN in the box immediately to the right of the mode number.
2. Press <enter> or use the cursor keys to move into the IOC: box, delete the value, and type in the new figure of 576.
3. Move into the LPM: box, and use the +/- keys until it shows 240.
4. Move to the Resolution: field, delete the default value, and type in a new figure of 1200.
5. Enter the Deviation: field and use the +/- keys till 'AM1' is displayed.
6. You will probably wish to move into the Intensity levels: field and increase the value to 256.
7. Use the +/- keys to set the APT-Mode: to 'squelch'.
8. Likewise, set the Phasing signal: to 'normal'.
9. Exit by pressing the <control> and <enter> keys simultaneously, which saves your selections and returns to the main menu screen.

That should be it! The other fields may safely be left as you found them. In practice, I have sometimes found Sich's radar-only transmissions sometimes fail to trip the squelch, but generally these settings work extremely well. Just make sure of course, that the gain control on your JVF interface is set sufficiently high so that the peak white pulsates above the 'W' marker at the right hand end of the histogram scale. To change to your new mode when in the JVFAX receive screen (assuming it is mode 10 as detailed above), just press Alt+0 (i.e. the 'ALT' key and the zero key simultaneously) and await your images. 🌐

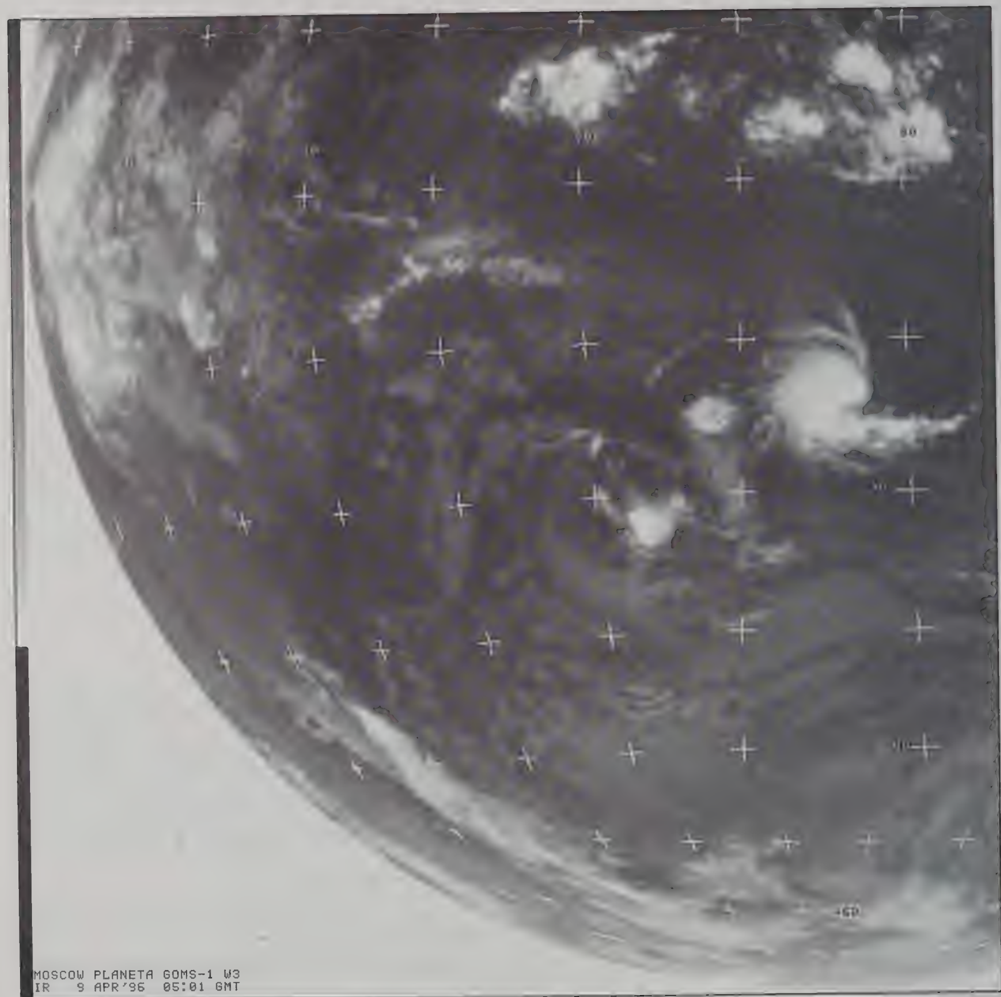
WORLD WEATHER HIGHLIGHTS
February-April 1996

Over this period the surface pressure in the Iceland area was well above normal and over Iberia was well below normal resulting in a virtual absence of the usual mild, moist, westerly winds across Britain and central Europe. Both temperatures and rainfall were well below normal in most of this area. In April, much of SE Britain had less than 25% of normal rainfall. Colchester recorded just 2.2mm making it the driest April for 103 years.

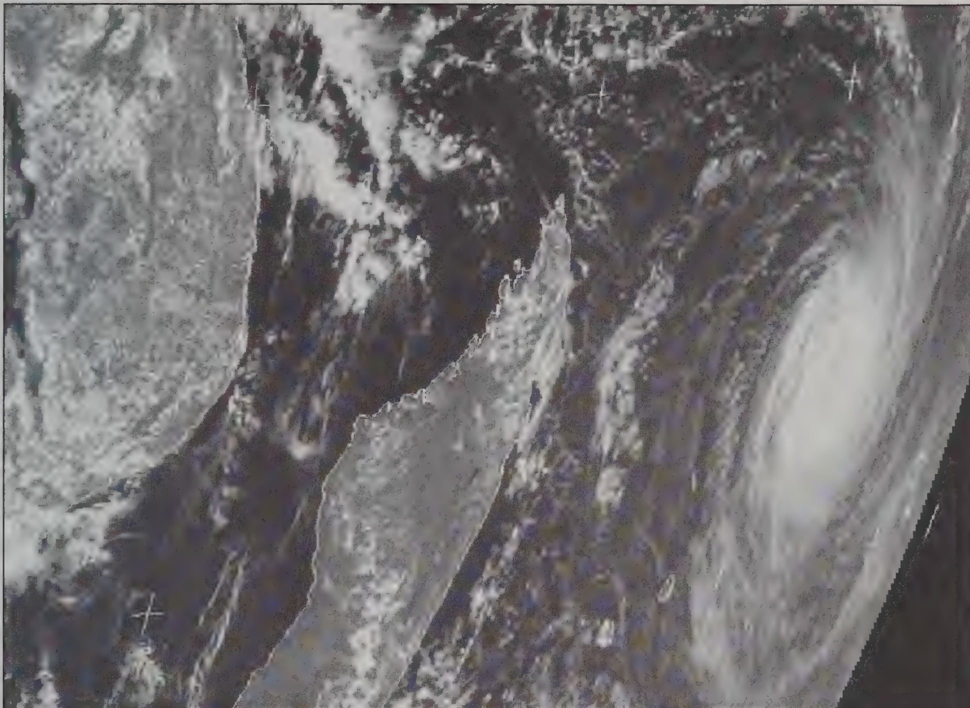
There was no shortage of rain in the northeast of Australia in March, however. Decaying cyclone Ethel dumped up to 200mm, most of it in one day. A late season cyclone, Itelle, developed south of the Chagos Islands in early April and is seen in its early stages of development in this infrared image from GOMS 1. It moved steadily west-southwestwards and by the time it came in to view of Meteosat 5 it was a spec-

tacular sight with sustained winds of over 120 knots. Fortunately for the residents of Mauritius it weakened considerably before passing to the north of the island.

During the first week in March, New York City experienced its 13th snowstorm of the winter which brought the season's total to a new record of almost 1700mm. More was to come and many parts of the northeastern USA experienced record total snowfall over the winter. 400mm of wet snow fell in parts of central Texas in one storm in April when, usually, the risk of frost is over. ⊕



GOMS 1 IR. 0500UT 9 Apr 1996. Image courtesy RPA Planeta, Moscow



Cyclone Itelle. Meteosat 5, 1200UT 14 April 1996

"WATCHING THE WORLD'S WEATHER"

A book review by Sam Elsdon

There are numerous books on meteorology, a few books on weather satellites and even fewer books on how to interpret weather satellite imagery. "Watching The World's Weather" by WJ Burroughs brings together all three facets into a concise and informative book which many readers would find a good supplement to Peter Wakelin's excellent series which appeared in past issues of RIG. It should be appreciated that this book will not tell you how to build a receiving station.

The book opens by describing how new ideas on weather systems were spawned by the wider view from space which has become such a common sight on our TV screens. Nowadays, not only the weather is viewed from space but all manner of environmental effects such as pollution, deforestation and ozone depletion to name but a few.

Next, the 'global weather machine' is explained with particular attention to the balance between energy absorbed by the planet and that radiated. The radiated energy

falls into several energy bands dependent upon its origin and through what intervening media it passes on its way into space. Later in the book, it will be seen how these energy bands are measured by the space craft to provide data on moisture levels, temperatures etc. Atmospheric and oceanic circulation as well as cyclones, frontal systems, hurricanes and storms are also described.

A historical review of the programmes leading to today's familiar NOAA and Meteosat/GOES missions follows. Starting from the first photographs of weather systems taken from space on a V2 rocket in 1947, through the early satellites specifically designed for meteorology in the late fifties, the TIROS programme of the early sixties, then ESSA, ITOS, NOAAs 1-5, TIROS-N and finally as far as NOAA 11, the reader gains some appreciation of just how much technological development has gone on in such a short space of time. The geostationary programmes are also covered briefly.

For those interested in the spacecraft instrumentation, the next section covers firstly what is available to measure in the form of energy of differing wavelengths (as mentioned earlier) and from which sources the energy emanates. Then radiometers, both optical and microwave are examined followed by applications of radar sounders to measure such things as wave height and direction which leads to derivation of surface wind data.

The above accounts for almost half of the book, the remainder being devoted to the interpretation of received images. A number of images are related back to what was learnt earlier in the book on cyclonic and frontal systems. Then, chapter by chapter, measurement of atmospheric structure, rainfall, land surface, sea surface, snow and ice and climatic change are examined in some detail.

Finally, Burroughs looks to the future of satellite meteorology and provides an extensive bibliography should the reader wish to pursue any topic further.

Considering that I found the book accidentally whilst browsing in a well known London book shop, it did not take many minutes to decide to purchase. My own interest in satellite imagery is in the technology with only a modest interest in how the weather 'works'. However, this book does such a good job of pulling together a wealth of information about the means to the end as well as the end itself that I had to buy it.

The book is well written and develops each theme clearly and logically, making it very easy to read. It is liberally illustrated with diagrams, charts, tables and photographs, many of which show the United Kingdom and north-west Europe. Oddly, little reference is made to the numbers on each illustration. Rather, one reads 'in the image, the warm front..........' but the image is three pages away and must be identi-

fied by reading the caption underneath. A minor groan about what is otherwise a very valuable addition to any satellite enthusiast's bookshelf.

Watching The World's Weather by WJ Burroughs (ISBN 0-521-34342-9) is published by Cambridge University Press, price about £19. ⊕

FLASH FLOOD KILLS 17 - CITY LYNCHES TV WEATHERMAN

Sicuani, Peru - When a flash flood tore through the town and killed 17 unsuspecting residents, riled-up survivors stormed the city's only TV station and lynched the local weatherman. A mob of cursing, club toting townspeople dragged bewildered weatherman Francisco Arias Olivera to a tree behind the station and strung him up before shocked cops could save him.

"That man committed mass murder, pure and simple," sobbed heartbroken Hortencia Silva, whose twin, 2-year old sons died in the deluge. "It was his job to warn us that a flood was coming, but he failed to do his job" "Many of us lost our homes, lost our loved ones, lost everything we had, so it was only fair that he pay with his life."

Ill fated Francisco, 32, had been a popular TV personality in this town of 21,000 before the day an unexpected downpour caused the Vilcanota River to surge from it's banks, washing away 250 homes and drowning 17 defenseless men, women, and children.

"The weatherman had told us to expect two inches of rain in 24 hours, and we got 19 inches in 12 hours," said police officer Adolfo Alcala. "Everyone had trusted Francisco, and when the flood came, they thought he had let them down." So just hours after the disaster struck, hundreds of hopping mad citizens looped a noose around a wide-eyed weatherman's neck and hanged him from the nearest tree. "Six of the vigilantes were charged with murder, but we were forced to release them because everyone here thinks the man got just what he deserved," Officer Alcala said. "So now, everything is slowly getting back to normal, except we're having a heck of a time finding anyone to be our new weatherman."

[I have been unable to verify the authenticity of this report. Ed] ⊕

DO YOU WANT A 5ft (1.5m) DISH?

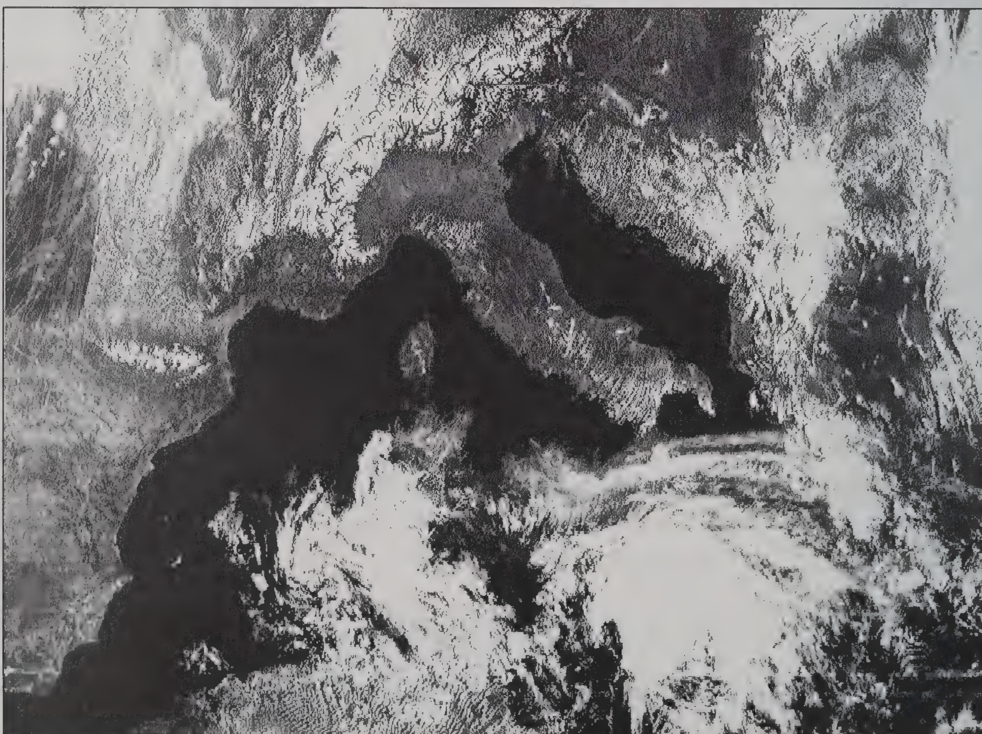
It has come to our notice that a supply of good quality, fibreglass dishes with a diameter of 5 feet (1.5m), complete with a substantial ground stand is available from a company close to Gatwick. The suggested price is £162 inclusive of VAT but this may be negotiable. Contact Italvision on 01293 821700 for more information. ⊕

AN ANALOGUE COMPRESSOR FOR SATELLITE SIGNALS

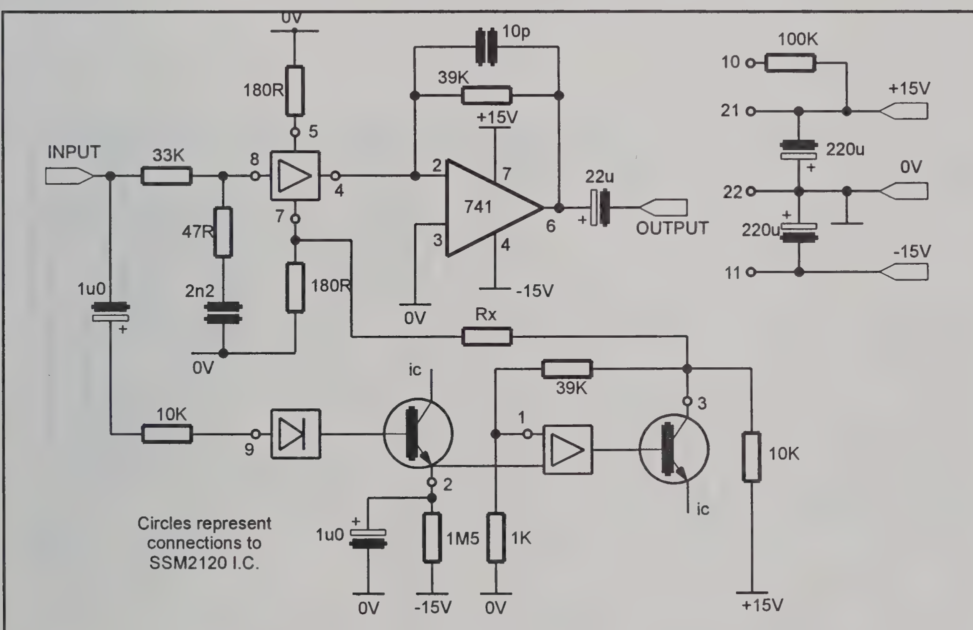
Ray Howgego G4DTC

This simple circuit was designed to enhance detail concealed in the lowest grey levels of satellite signals. It is particularly effective in revealing ground surface information in weakly illuminated METEOR images and may be usefully applied with reduced effect to METEOSAT APT and NOAA visible APT transmissions. It will successfully retrieve the enormous wealth of ground detail generally hidden in the near-black levels of METEOR European passes which often convey little more than cloud cover.

The circuit is designed around the Analog Devices SSM2120 dynamic range processor IC. The chip contains two compressor/expander circuits, only one of which is used, in compression mode. The chip offers very low distortion (0.005%) with a compression ratio between unity and >10:1 dependent on the value of one external resistor. When an analogue satellite signal is applied to the chip it will increase the range of variation of the lowest amplitudes in the signal (the dark grey levels) while decreasing the range of variation of the highest amplitudes (the white levels). The resulting ratio between these variations is then the compression ratio.



Suppose that the image is stored by software in 256 grey levels and that a compression ratio of 10:1 is selected. Information which previously occupied only the lowest grey level will now expand to fill approximately the lowest 10. Variations in cloud cover will be compressed into the few highest levels producing a rather bland grey-white, but without saturation. Such an improvement could not be implemented by software, which could never operate on more than the one grey level originally stored and would simply produce a highly contrasted mess. The efficacy depends very much on the linearity of the image sensors; whether or not the satellite actually transmits more than 256 grey levels; and to what extent the black level is really zero amplitude. NOAA infra-red images clearly fail the third demand and would benefit from expansion rather than compression. The thumping, wide amplitude METEOR signals, which unfortunately lack visible linearity in the lower grey levels are beautifully restored by image compression.

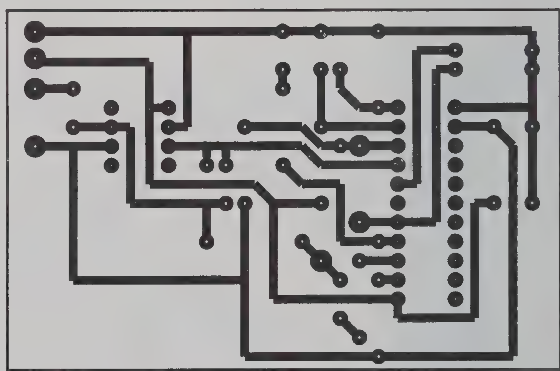


The SSM2120 is available from Maplin Electronics and the design leans heavily on their applications note of November 1991. It is rather pricey at around £10 but few other components are needed. The circuit diagram might look a little complicated as much of the circuit (between the small circles, which are the pin connections) is contained within the chip itself. The external op-amp (741 or anything similar) is included simply to restore the overall gain, determined by the 39K feedback resistor. Although a split 15V supply is optimum, the circuit functions quite happily down to

4V. The board should be wired, without fuss directly between the receiver and the computer interface. Enthusiasts might evaluate gain adjustment both before and after the circuit but unless you really enjoy being driven insane by knob twiddling it is best to keep it simple!

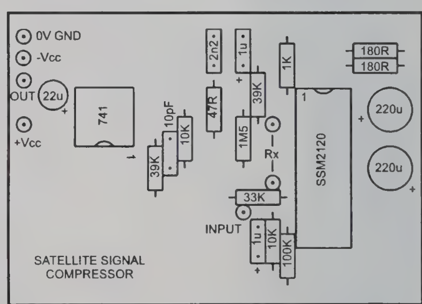
The resistor Rx, given vacant posts on the PCB, controls the level of compression and might usefully be made variable. Try a 15K or 22K potentiometer, connected in series with a fixed 2K2 resistor, the minimum sensible value for Rx. The calculated compression ratios are:

Rx	Compression ratio
11.8 K	1.5:1
7.8 K	2:1
5.8 K	3:1
5.133 K	4:1
4.8 K	5:1
4.415 K	7.5:1
4.244 K	10:1



The present author, using the Martelec JVF2 interface, found that Rx = 4.55 K was about optimum for METEOR signals, but others will require experiment.

Once the board has been connected between the receiver and the interface, with a steady signal from either METEOR or METEOSAT (preferably a tape-recorded transmission) gradually reduce the value of Rx and watch the effect. Below 5K adjustment is very critical. If you are using JVFAX, you should enable ATC to cope with the varying range of amplitudes. You should look only at images, or parts of the image which contain the lowest grey levels. A sure sign that things are working well is that any noise (which previously might have lurked in the lowest levels) will become all too apparent and this will place the ultimate restriction on the usability of the circuit, particularly if you are receiving METEOSAT with a smaller antenna than recommended. METEOR transmissions on a crossed dipole should, however show very little noise content. ⊕



TECHNOLOGY FOR THE NEW GENERATION OF NOAA SATELLITES

John Green

At the recent meeting of the Gatwick local group organised by John Boyer there was a discussion concerning the proposed new digital transmission mode for the European METOP-1 satellite and the next generation of NOAA weather satellites. John Tellick went through a NOAA questionnaire which outlined the Low Rate digital Picture Transmission (LRPT) mode. Two of the new features are the possible use of the JPEG algorithm for data compression and the use of DQPSK modulation.

Nobody at the meeting was very familiar with the details of JPEG or DQPSK, so as Peter Wakelin said he was short of articles for RIG45 I offered to write a brief description. I know a bit about JPEG but next to nothing about DQPSK so I had to dust off some textbooks. Feel free to expand or correct what follows by writing a follow-up for RIG46.

Image Compression using JPEG

JPEG stands for the Joint Photographic Experts Group. This committee produced a standard for image compression entitled 'Digital Compression and Coding of Continuous-tone Still Images' in the late 1980s. The technique described has been widely used and is now an official ISO standard.

The motivation for using image compression is to reduce the number of bits needed to describe an image. This enables a reduction in transmitted bit rate which reduces the bandwidth required. This is important at VHF frequencies as the channel bandwidth is very limited. LRPT should produce a picture with a similar resolution to HRPT using a much smaller bandwidth. However the "No free lunch" rule applies in space just as much as it does on Earth and this result is only achieved by discarding bits from the original image using lossy compression. This means that the original picture cannot be reconstructed exactly at the receiving end. The JPEG technique is a method of ensuring that the right bits are discarded so that the differences are negligible.

Encoding, or compressing an image using JPEG is a four-stage process:

1. Division of the image samples into square blocks each 8x8 pixels in size
2. Transformation of each 8x8 block using a mathematical transform called the two-dimensional (2D) Discrete Cosine Transform (DCT)
3. Quantisation of the DCT coefficients
4. Encoding of the quantised DCT coefficients

The decompression process gets back to a picture by performing an inverse of each

of the four stages.

The key process is the 2D DCT which is similar in form to the better known 2D Fourier Transform. It produces a 2D array of coefficients with the coefficient at (0,0) corresponding to the DC term and the other coefficients corresponding to the amount of energy in the image at various spatial frequencies. This particular transform is chosen as it has the property of concentrating energy into the low frequency coefficients. With a "typical" picture most of the higher frequency coefficients will be close to zero. The compression is achieved by quantisation of the coefficients so that they can be stored at a lower precision than that used for the original samples.

Quantisation is performed by dividing each DCT coefficient by the corresponding element in an 8x8 quantisation array, Q, and rounding the result to an integer value. Larger values in Q reduce the magnitude of the results and give a larger compression ratio. The Q array to be used with LRPT will presumably be defined by NOAA and EUMETSAT, using values selected to give good results with typical weather pictures at the required compression ratio.

The fourth stage encodes the quantised coefficients into the final format. This is done using a combination of strategies including: storing differences between DC terms in adjacent blocks, rather than storing the absolute values, run-length encoding of AC terms that are zero and using Huffman codes. The details are a bit messy but the end result is an exact representation of the quantised DCT coefficients using fewer bits.

To summarise, the bit savings come from a lossy quantisation of the DCT coefficients followed by a lossless encoding of the quantised DCT coefficients. Quite high compression ratios, 10:1 or even 15:1 can be achieved on 'natural' scenes. Sharp edges or lines introduce high spatial frequencies leading to significant DCT coefficients away from the DC term. These cannot be quantised to any significent extent without introducing artifacts into the reconstructed image.

Where JPEG is used for file compression the file format is defined in the standard using various marker codes to delimit the various components of the compressed image. Presumably NOAA and EUMETSAT will define the format of the transmitted bit stream to enable decompression at the receiving end.

The receiver will have to demodulate the incoming signal and then essentially reverse the processes described above to produce a picture. Dedicated chip-sets are available to do this computation but real-time software decompression at the data rates for LRPT should be possible. A quick test with an old version, 2.1, of the WinJPEG shareware program running on a 25MHz 386 took about 40 seconds to read, decompress and display a 600x1000x256 level compressed OKEAN image. This corresponds

to a decompression rate of 120kbits/second.

Digital Transmission using DQPSK Modulation

The bit stream coming out of the JPEG encoder is used to modulate the VHF carrier using DQPSK modulation. So what exactly is DQPSK and why did NOAA choose it?

Starting with the easy bit, PSK stands for Phase Shift Keying. A PSK modulation technique shifts the phase of the RF carrier in a manner which is related to the bit stream which is to be transmitted. In BPSK or Binary PSK only two phases are used, 0 and π (180 degrees). If the bit stream from the JPEG encoder output was ...0 1 0 0 1 0 1 1......, the phase of the RF carrier at the output of the BSPK modulator would be 0 π 0 0 π 0 π π .... This sequence of 0s and πs is conventionally referred to as the transmitted symbol stream. For BSPK each bit is represented by a corresponding symbol.

Quadrature (or quaternary) PSK , QPSK, uses four phases, π/4, 3π/4, 5π/4and 7π/4, each representing two bits from the original bit stream. Four phases are needed as two bits can have four values: 00, 01, 10 and 11. In other words each transmitted symbol represents a pair of bits from the original bit stream and the transmitted symbol rate is half the original bit rate.

A QPSK signal can be coherently demodulated using a locally generated carrier recovered from the incoming signal. Unfortunately carrier recovery circuits can introduce a phase ambiguity in the recovered carrier which plays havoc with the bit error rate. To get around this Differential QPSK, or DQPSK is used. In this scheme information bits are represented by a phase shift from the previous phase rather than by the absolute phases used by QPSK. DQPSK can be demodulated without a carrier recovery circuit which simplifies the receiver.

The choice of a digital modulation scheme is always a compromise between a number of factors including power efficiency, required bandwidth, complexity at the transmitter and the receiver, susceptibility to fading and other distortions and error performance. In principle each of the fundamental parameters of a sinusoidal wave, amplitude, frequency or phase could be used as the basis for a digital modulation scheme. Using phase, as in BPSK, gives the best performance of the three as measured by error rate for a given signal to noise ratio. QPSK has the same error performance as BPSK but requires approximately half the bandwidth for a given bit rate. QPSK is also better suited to the particular characteristics of the power amplifiers used in satellite transmitters than BPSK. DQPSK sacrifices some of the performance of QPSK in order to simplify the receiver.

Hopefully NOAA will provide further details of the compression and modulation

techniques to be used for LRPT in the coming months. Until then I hope this article has provided some background to the technologies involved. Further reading can be found in the ISO JPEG Standard, ISO/IEC 10918-1 which is available on the World Wide Web at http://icib.igd.fhg.de/icib/it/iso/is_10918-1/read.html#Contents. DQPSK is mentioned in most recent books on communications theory, usually accompanied by dozens of pages of maths!

SICH RADAR IMAGES - LOSS OF SYNC

Do you use Timestep's PROsatII system and have difficulty in getting straight images from some of the SICH transmissions? I used to find that when the transmissions consisted of only a radar image the picture just refused to synchronise, yet other combinations of vis, microwave and radar images were OK.

Timestep suggested that a drift in the PLL circuitry *may* be the cause and tweaking the pot at centre rear of the card *may* solve the problem. Well, it *was* the cause and tweaking the pot *did* solve the problem. The PLL frequency should be 2400Hz whereas mine had drifted to 2440Hz.

To facilitate adjustment there is a short programme called TESTD.EXE. Here's what to do:

1. Download TESTD.EXE from the RIG BBS.
2. Unplug ALL connectors from the PROsatII card.
3. Run TESTD.EXE
4. Hit ESC
5. Hit F key - frequency digits will go big.
6. Set pot at centre rear of PCB to read EXACTLY 2400Hz
7. Be sure to set to: Okean/Stripes/Synchronous
8. Enjoy straight images.

Timestep stress that there may be other causes for loss of sync and they cannot guarantee that the above solution will be effective in all cases. It's worth a go. PW.

WEATHERSAT INK

At the time of writing, it is about six months since an issue of this magazine appeared. Attempts to establish the current status of production have been unsuccessful. We are aware that one of our members applied for a subscription in February, had his card account debited by more than the amount advertised in the RIG journal and has still received nothing. Until the position is clarified, we advise against applying for, or renewing, a subscription.

COMPUTER CONTROL OF THE DARTCOM SCANNING RECEIVER
Roger Golding

I started off with fairly typical system; the RIG Dartcom scanning receiver module, a crossed-dipole aerial with a mast-head amplifier, a Martelec JVF2 interface and the superb JVFax program (version 7). My system suffered badly from 'pager' interference and removing the amplifier helped considerably.

Having whetted my appetite with the polar satellites, I then wanted to receive the geostationary Meteosat 5, so I added the RIG Dartcom downconverter and a 1 metre dish.

Initially, I had to swap over aerial leads to get the polar and the geostationary satellites. My first modification was to add another aerial socket and a co-ax relay, controlled by a front panel switch.

The Dartcom downconverter was set to choose Meteosat channels by sensing the voltage fed to it up the co-ax cable. The original 'power up the coax link' on the receiver pcb was replaced with a diode, and the diode had a switch wired across it, to short it out. With the switch closed, the full voltage went up the aerial lead and, with the switch open, the diode dropped the voltage slightly, which was sensed by the downconverter as the signal to change channels. A small capacitor was added to the polar aerial socket to block the dc from going to the crossed dipoles as I had removed the head amplifier.

As I was now hooked on the hobby, I resented going out in case I should miss anything! I could only leave the system set for either the polar-orbiters or Meteosat 5 so some kind of automation was needed.

Having become more familiar with the facilities of the JVFax program, I wanted to use the 'timetables' to automatically capture the satellites in my absence. After reading the Martelec manual, I noticed that they could control their IMR50 Meteosat receiver via the JVF2 interfaces 'Aux' socket. I needed to be able to do two things automatically:

1. Select the appropriate aerial input socket
2. Select the required channel when on Meteosat

I would not be able to set the receiver's frequency automatically but if the receiver was left on scan, with the squelch on, this would not matter unless 2 polar-orbiting satellites go by at the same time, which rarely happens.

In the JVFax program, you can select a 'Mode' for each satellite. Each Mode includes

the control of two outputs which are known as:

Tx-Hw-Flt (this sets pin 2 on the Martelec interface)
Rx-Hw-Flt (this sets pin 3 on the Martelec interface)

These signals are at the heart of the control system.

Figure 1 shows the basic system but, after adding this, I came across an unexpected problem. Part of the concept was that the receiver would be left on scan to find the satellite signals, which worked fine for the polar-orbiters, but not very well for Meteosat. I often missed images, as Meteosat 5 often transmits a very short signal in front of the 'start signal' and the receiver would still be scanning. By the time it locked onto the signal, the phasing part of the image had already been transmitted. A method of holding the receiver on 137.50 MHz when Meteosat was selected was needed, even if no signal was being broadcast at the time.

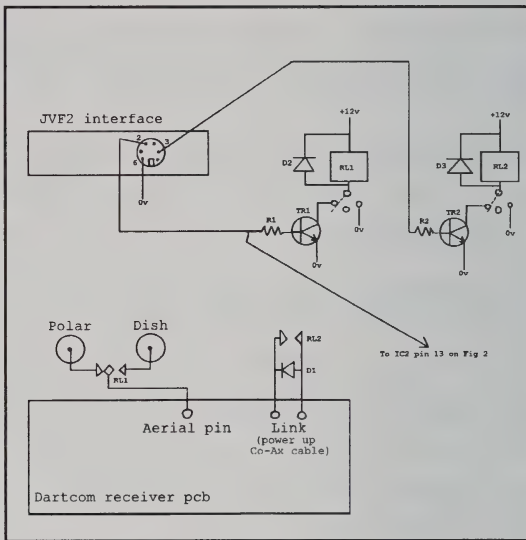


Fig. 1.

Figure 2 shows the solution to this problem. The frequency 137.50 MHz (the downconverter's output frequency) is stored in the receiver's prom at memory address 6. The 'AND' gates and 'inverters' stop the receiver scanning further than this prom address, providing the Meteosat aerial is also selected.

Prom address 6 is decoded from 1,2,4 and 8 in binary. The '2' and the '4' are 'anded' together to make '6', the '1' and the '8' are inverted to become 'Not 1' and 'Not 8'. The 'Not 1' is 'anded' with the 'Not 8', so you get a unique output only when address line 1 is low, 2 is high, 4 is high, and 8 is low, i.e. prom address 6.

This signal is then 'anded' with a signal produced when Meteosat is selected. The result is that the receiver cannot scan beyond address 6 when on Meteosat but it can when the polar satellite aerial socket is selected.

Naturally, the connections to the '2732' prom should not be made directly to the prom legs, but to pcb tracks and it is easy to find them with an ohm meter. Address '1' is on pin 6 of the prom, '2' is pin 11, '4' is pin 14, and '8' is pin 2.

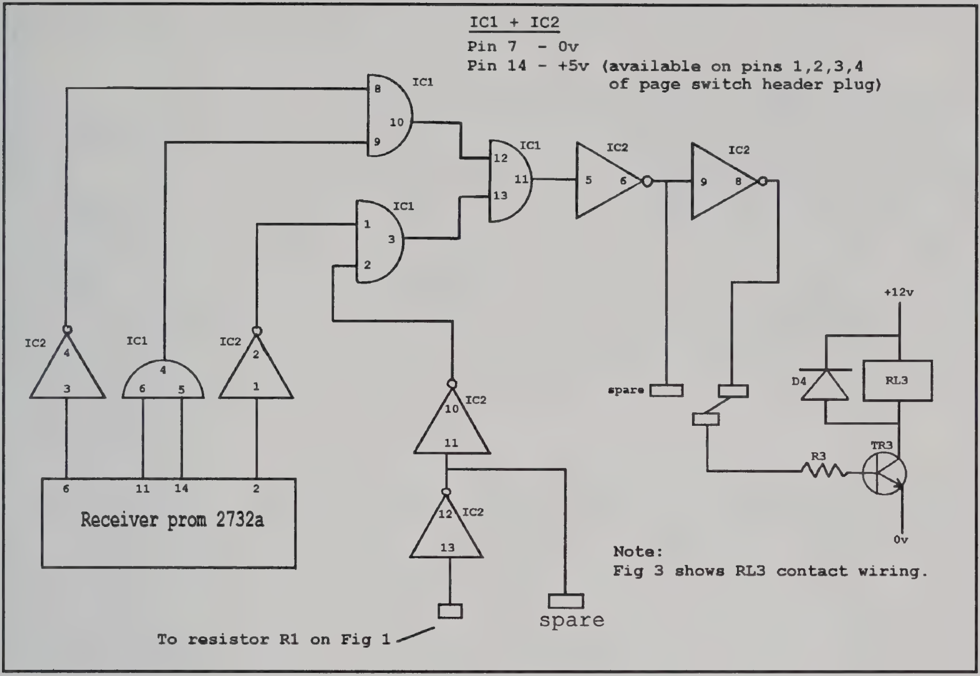


Fig. 2.

The circuit looks much more complicated than it is. Only 2 chips are used, and most of the wiring is little more than joining the legs of the chips together.

The JVFax 'mode' signal Tx-Hw-Flt is used to select the aerial socket, and Tx-Rx-Flt is used to select channel 1 or channel 2 when on Meteosat. The JVFax 'Modes' for each satellite should be set as follows:

		Tx-Hw-Flt	Rx-Hw-Flt
Meteosat - channel 1	-	off	on
Meteosat - channel 2	-	off	off
All polar satellites	-	on	on or off-it does not matter

The system has been in use for several months now, and the only weakness is that when on polar-orbiters, the receiver locks onto the first satellite it finds, as the control system does not set the receiver's frequency, but it is rare for two to be in the same area at the same time.

The two switches give manual override facilities for the aerial socket and Meteosat channel selection. This circuit, with all relays operated will draw around 180 milliamps, so if you use the receiver's power supply, make sure it can cater for the added load.

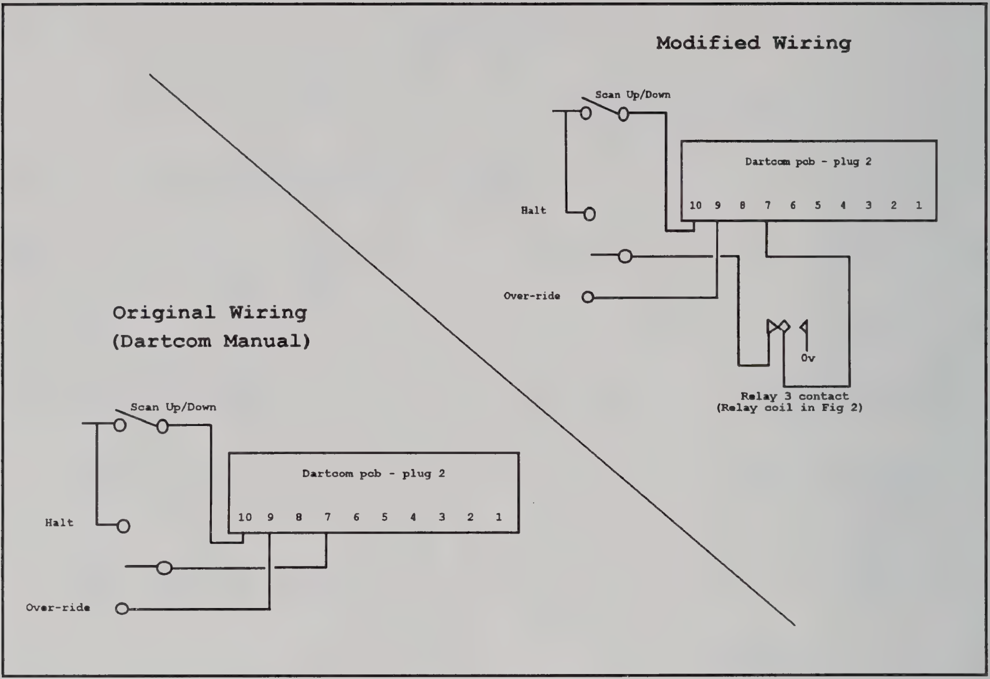


Fig. 3.

Parts List:

Figure 1

D1	- IN4002
D2 + D3	- IN4148
TR1 + TR2	- BFY51 or similar
RL1	- Co-ax relay (Cirkit:46-91120)
RL2	- Relay, coil 12v/400 ohms
R1 + R2	- 22k, any kind
Switches	- 3 position toggle

Figure 2

IC1	- 4081
IC2	- 40106
D4	- IN4148
TR3	- BFY51 or similar
R3	- 22k, any kind

Figure 3
Re-used existing switches as per the Dartcom manual for suggested wiring. ⊕

AN OKEAN'S-EYE VIEW OF SVALBARD

Les Hamilton

Okean 1-7 which has proved the longest-lived and by far the most reliable of Russia's oceanographic satellites to date, frequently targets the archipelago of Svalbard, far to the north of Norway in the Arctic Ocean. From discussions I have had with RIG members who live in Britain's southern peninsula (England!), it seems that they are unable to receive Okean transmissions from these latitudes (75 to 80 degrees north of the equator). From my vantage point in Aberdeen, descending Okean passes generally commence a short distance north of Svalbard, its microwave and radar sensors providing year-round imagery of the islands and the seasonal movements of the Arctic ice sheet. The images accompanying this article illustrate part of this annual cycle. The images occur in pairs, the microwave image to the left, and the radar image to the right in each example.

But first, a few words about Svalbard itself. The name means "cold edge", reflecting that, situated just 1000km from the North Pole, the islands lie on the edge of the Arctic ice for most of the year. Consequently, 60% of Svalbard is covered by permanent ice and permafrost renders most of the land surface frozen to a depth approaching 500 metres. Only the upper 2 to 3 metres thaw out during the short summer, when the islands are claimed to support over 150 species of seabirds as well as polar bear, reindeer, arctic fox and the Xstmark mouse. Large deposits of coal have ensured the presence of a permanent human population of around 3000 people as both Norway and Russia exploit it as a much needed source of fuel.

Our picture story commences in August 1995 when the perpetual summer sun has forced the ice to retreat northwards. The islands are surrounded by liquid water, although the ice is plainly visible on both the microwave and RADAR images, little more than 80km to the north. By early October, little has changed but by 30 October winter has set in with a vengeance and both images now show significant evidence of ice formation to the east of the islands. By mid-November they are firmly embedded in the Polar Ice-cap. This situation remains largely unchanged for the next two months and the 15 January 1996 image shows the ice particularly well. However, by the end of January, ice to the west of Svalbard is already retreating due to the combined influences of the Gulf Stream and the return of sunlight and by 5 February the western coastline is almost free of ice. In the final images in this sequence, which were taken in the first half of March, the ice has released its grip on the western coastline of the main island of Spitzbergen, and also started to retreat from the island's south-eastern shores.

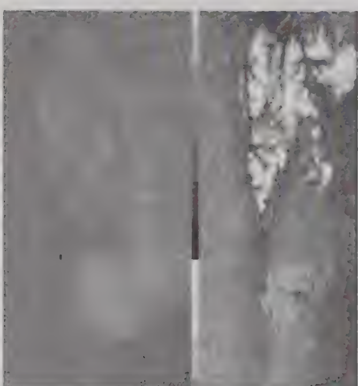
It is unfortunate that Okean's imaging of Svalbard tends to be rather irregular, but this sequence of images does provide an interesting winter-long insight into the movements of the ice around the islands, unhindered by cloud and lack of daylight. 🌐

Aug 20, 1995

Oct 13, 1995

Nov 27, 1995

Dec 24, 1995



Jan 30, 1996

Feb 5, 1996


Oct 30, 1995


Nov 18, 1995


Jan 9, 1996


Jan 15, 1996


Mar 5, 1996


Mar 11, 1996

HOW TO MAKE NEAT FRONT PANELS

Mark Pepper

During the recent RIG conference in Chester I had on display my latest satellite receiver made using RIG*sat* RX1, RX1a and IF1. However, what seemed to interest most people was how I had made the front panel. My panels contained text describing the functions of the controls along with snazzy graphics adding appeal and a professional look to the finished receiver and all coated in durable acrylic. So for all those who weren't there or were too afraid to ask, here's how it's done.

1. Measure and plan the front panel as accurately as possibie and draw it, life size, using any convenient computer drawing package. I use Corel Draw.

2. Obtain a large A4 laser-proof sticky label. Don't get the multiple-label type of sheet but get a label that is the full A4 size. Print the design you drew onto this label with a laser printer.

3. Obtain a sheet of lamination film. This is used to coat single sheets of paper in a plastic layer to make them durable. The film is heat fixed to the paper sheet. Take just one side of the usual two sided film and iron it onto the sticky label with the printing already on. Some considerable heat is needed to fix the film to the label and the label tends to curl up. This can be countered by ironing the back of the label afterwards, not forgetting to put a blank sheet of paper between the iron and label backing first.

4. Cut out the label including all the holes for equipment that will protrude through the label and use these cuts to mark your front panel for hole cutting. You could include punch and cut marks on the parts of the label that will later be removed.

5. When the panel is prepared simply stick on the label and mount the panel's components.

There are other things you could do too. You can cut out sections of the label prior to ironing on the lamination film to produce see-through areas for displays or LEDs. You could colour areas in for coloured panels or use fancy graphic effects to enhance the panel's appearance. You don't have to use a laser printer, you could use any type of printer or even a simple pen although I suspect that some pen's ink may be affected by the heat during lamination.

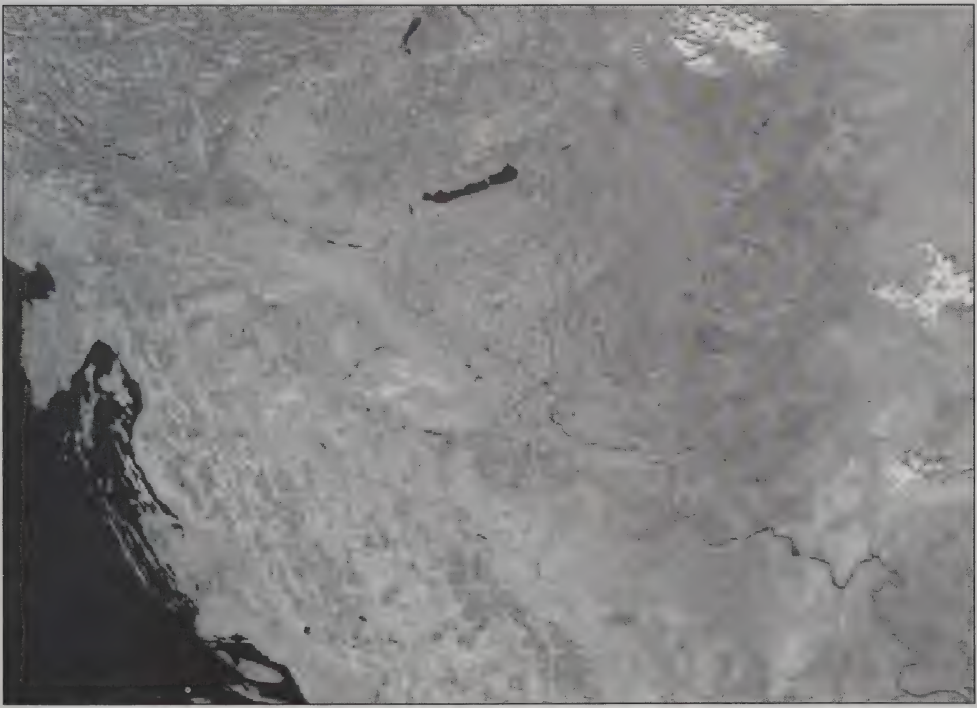
So now you have no excuse for drab, unhelpful panels. How many projects lie on a shelf never to be used again because you cannot remember what the knobs do? 🌐

INTERPRETING WEATHER SATELLITE IMAGERY - PART 14

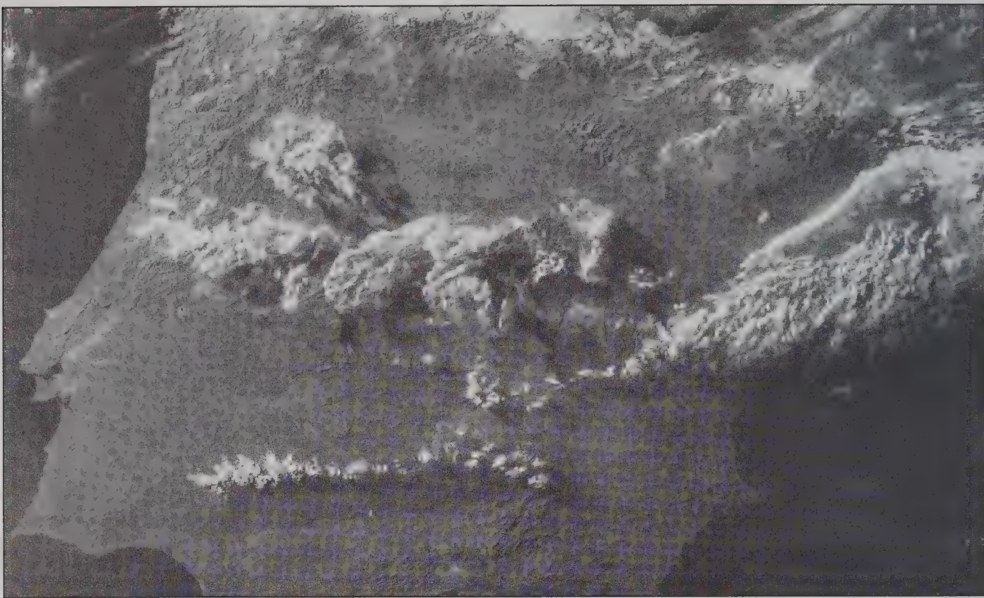
Peter Wakelin

During April and May several people have remarked that the quality of their NOAA 14 visible images had deteriorated and they asked if I knew of any problems. To me, the imager seems to be performing flawlessly and upon trying to establish the likely problem these people were experiencing, I realised they all had one thing in common; they were relatively new to this intriguing hobby of ours. I suspect that what they were noticing was the effect of changing illumination .

Except in tropical regions, the Sun is 47 degrees higher in the sky at midday in high summer than it is in mid-winter. At temperate latitudes the northbound NOAA 14 passes are overhead at about 1300 local time which is only an hour or so after the Sun has crossed the meridian. This means that, for example, in Madrid, with a latitude of 40 degrees, the Sun is at about 25 degrees elevation when NOAA 14 passes overhead in mid-winter but is at more than 70 degrees in late June. Not surprisingly, this big difference in illumination is reflected in the appearance of the image.



NOAA 13 Ch2 vis image of the former Yugoslavia. 14 August 1993, 1210UT



Iberia in evening sunshine, NOAA 12 Ch2 vis, 17 July 1995, 1900UT

As a general rule, in a typical temperate region with some cloud around, an image under high-angle illumination will appear much less contrasty, or 'flatter', than the same scene under low-angle illumination. The two images I have selected to show the effect of different angles of solar illumination are extreme cases. Both are channel 2 HRPT images and the first is from NOAA 13 (one of the few I got from that short-lived craft) in summer with the sun around 60 degrees elevation over much of the scene which includes the River Danube and the former Yugoslavia. The second is from NOAA 12 and shows most of Iberia with the evening sun just a few degrees above the northwest horizon. They are not mid-summer and mid-winter images from the same satellite but the big difference in angle of illumination clearly has a dramatic effect.

In the image of the former Yugoslavia, what little cloud there is has short shadows and the small changes in tone of the ground are due to variations in reflectances of soil and vegetation. Only the water bodies are really prominent. In the image of Iberia, the clouds have very long shadows and the southeastern slopes of hills are noticeably darker than the sunward sides giving a three-dimensional look to the whole scene. This effect is very noticeable in the south where the Sun's elevation is about 4 degrees. The narrow line of convective cloud lies along the ridge of the Sierra Morena and the southern slopes of the hills are receiving very little sun but just across the parallel valley to the south there is increased illumination. There are a few places in the centre of the image where cloud shadows can be identified with

the cloud elements causing them and in some places the shadows are more than 80km away from the clouds; a good indication that the Sun is *very* low in the sky.

Of course, there are other reasons for changes in appearance of a cloud-free scene other than the changing illumination. In many parts of the World seasonal changes in vegetation cover are dramatic and high resolution images are not needed to detect them. Most countries in and around the Mediterranean Sea, apart from those bordering the northern coasts experience four or five hot, summer months totally devoid of rainfall and the increase in reflectance in early summer when the land turns from lush green to a parched yellow is quite noticeable. Monitoring a selected area under differing levels of illumination and through a complete cycle of seasons can be very interesting. 🌐

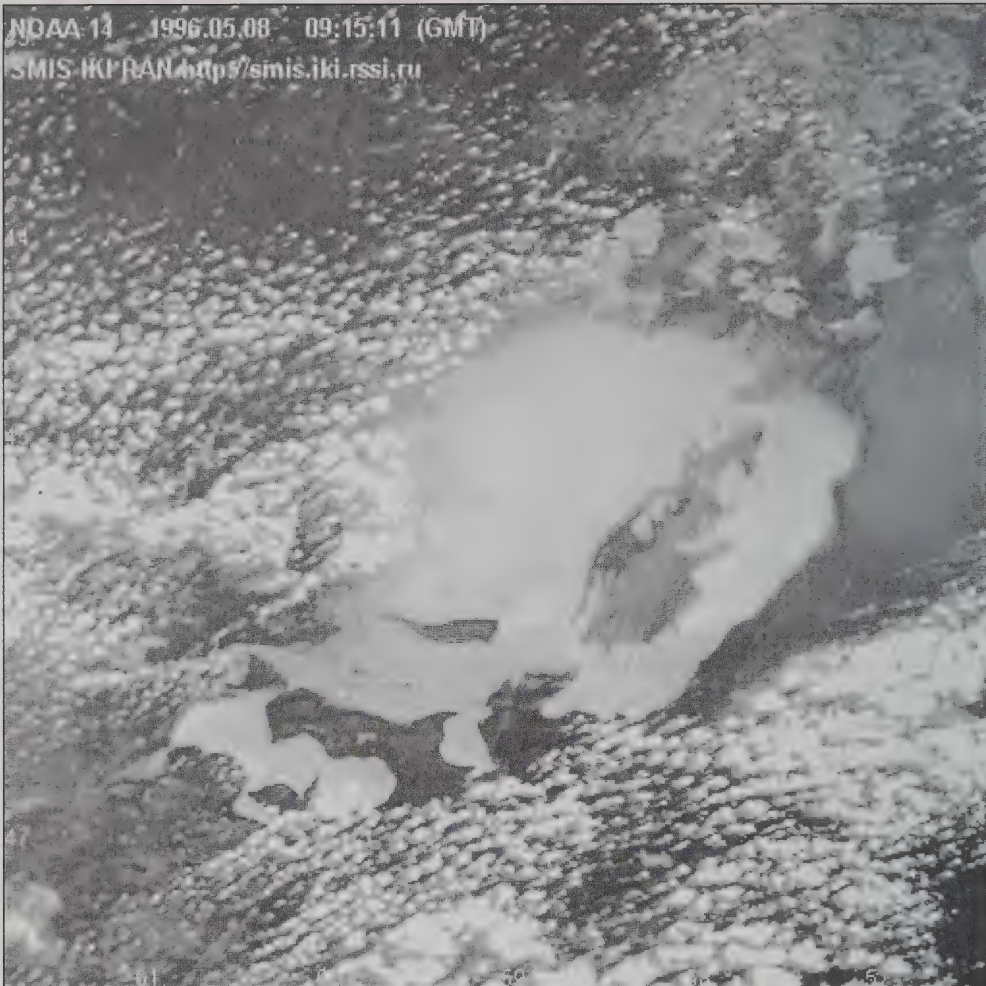
INTERNET NEWS

The URL for GOMS information has changed from that reported in the last issue. It is now: http://smis.iki.rssi.ru/goms/goms_d.htm. Internet is growing rapidly in Russia and this site can lead you to a lot of interesting stuff. Near-real-time NOAA HRPT images are available for selected areas prone to flooding during the snow-melt season and also of the Aral Sea. /data/flood96/ on the same site is where to find them. In the image reproduced here, from an early afternoon NOAA 14 pass, the cold water of the Aral Sea contrasts strongly with the warm land. The area of the islands has increased dramatically in recent years as the water level falls due to extraction from inflowing rivers for irrigation. North is at the bottom of the image which is courtesy Space Monitoring Information Support (SMIS) of the Russian Space Research Institute (IKI).

Nick Kew's assemblage of information on imaging spacecraft is very comprehensive and is kept up-to-date with regular revisions. Satellite Imagery FAQ is available on several newsgroups, including sci.geo.meteorology, but if you cannot face the ordeal of sifting through the vast quantities of trivia found on most un-moderated newsgroups then it is available from this URL: http://www.geog.nott.ac.uk/remote/satfaq.html.

RIG member Mike Robinson has his own homepage. Apart from images and up-to-date information, he has assembled a very comprehensive list of Web sites with links to dozens of organisations likely to be of interest to RIG members. It's well worth a visit. Well done, Mike! The URL is http://www.airtime.co.uk/users/homebase/homebase.htm.

It is almost two years since the Space Shuttle last carried the SIR-C/X-SAR radar



NOAA 14 IR image of the Aral Sea. (North at bottom)

imaging equipment but the vast quantity of data acquired are still being processed and new images, similar to the one on the front cover of RIG 39, are made available from time to time. Try the "News Flashes" section at htp://www.jpl.nasa.gov/.

SHAREWARE CORNER

LES HAMILTON

Quite a mixed bag of shareware this time, with both new and upgraded shareware on offer. For those of you who followed Mike Cook's articles on NASA CD-ROMs a few issues ago, PDSWIN is the Windows image browser designed for viewing these images. You will find this much more efficient than the DOS IMDISP viewer offered for use with the CDs as it runs under Windows and all operations are mouse controlled.

From the author of STSPLUS comes ORBITEL, a utility for extracting specific groups of 2-line orbit sets from large data files. For observers wishing to check up on the Earth, there's a new version of GEOCLOCK, while those interested in graphics will find NEOPAINT v 3.2 decidedly useful, particularly as the GIF format has been restored.

Colin Hall has been in touch concerning SATSPY, offered last issue. Although he managed to run it successfully on his 386-PC, he was unable to install it using Windows-95 on a Pentium PC. If any member has any ideas about solving this problem, I will be pleased to hear of them and pass them on.

Another program causing problems is PhotoVision Pro. Alex Witkin tells me that after the trial period is over, images saved by the program carry a 'watermark' stating that the program has now been used beyond its trial period. However, the program can still be used to enhance images prior to printing out, providing the image is not actually saved in its modified form.

PDSWIN v 2.0

This program offers an extremely user-friendly interface for viewing the contents of NASA Planetary Data System CD-ROMs featuring images taken on the Voyager and Magellan missions. These CDs were reviewed in Journals 41 and 42 by Mike Cook, and contain some highly interesting material. The only viewer offered for use with these images was Imdisp, which is fine up to a point, but is a command-line operated program. PDSWIN now offers mouse driven Windows functionality. Note that the images are not in standard graphics formats and cannot be viewed using conventional viewing programs.

Running the PDS20.EXE file creates a directory called PDSWIN within which is the main program file PDSWIN.EXE. This can be run from Windows Program Manager.

The CD is accessed in the usual way and once the first image has been loaded, you can simply browse the entire directory by means of a set of "tape recorder control buttons" on the program's toolbar. If the toolbar is not present initially, display it with a click on the 'toolbar' option in the <View> menu. There are tool-bar buttons for almost all the programs features. These include a powerful zoom, effected by simply clicking the mouse over the image - left button magnifies, right button reduces - and an Info button which opens a small window giving full details about each displayed image. There is a histogram option with which one can adjust both the brightness and contrast of an image by means of mouse controlled slider bars and the final image may be saved to disk in BMP format. [Disk I-07]

ORBITEL

From the author of STS Plus, Orbitel is a program which can verify, merge and sort standard 2-line orbital elements files. It can also select sets of satellites according to user-set criteria and save these to a separate file. Orbitel can also be used to verify and correct the checksums at the end of each line of a 2-line element set, avoiding the laborious task of doing this by hand. The program operates by means of the function keys. F1 displays generalised information on 2-line element sets, explaining clearly the significance of each grouping of figures. This is a useful and informative feature, which would be specially useful to those new to the concept of 2-line element sets. Key F2 opens up the display of 2-line data for satellites and produces a comprehensive annotated listing of the two-line elements themselves as well as derived data (e.g. semi-major axis, launch date etc.). F3 instigates the checksum verification option while F4 allows you to write a new sorted file with corrected checksums. The program has additionally, a number of command-line options and it can usefully be run from a batch file. [Disk T-08]

SORTNENG

This is a much improved version of the program reviewed in RIG 43. Sortneng is another program capable of producing sub-sets of 2-line elements from large files. However, it gives the user a greater degree of control by allowing one to prepare a reference file containing the names of the specific satellites to be extracted. This version verifies checksums and discards faulty element sets. [Disk T-08]

GEOCLOCK v 7.1

This is the latest version of the popular DOS sunlight clock for displaying night and day over the surface of the Earth. The current position of the sun is displayed and the regions of the Earth's surface in sunlight and twilight are highlighted. A configure program allows you to set up Geoclock for your own location and time zone and local sunrise/set are displayed. This version of the program will interface with the

QRZ CD-ROM databases (provided you have a CD-ROM drive), which should make it an attractive proposition for radio amateurs. There is also a Windows version of Geoclock. In operation I found it considerably slower than the DOS version (on a 486 DX40 machine) and also features an irritating "nag screen". Otherwise, the only significant change is that the button-bar used to select Geoclock's functions has been replaced with conventional drop-down menus. However it is available to anyone who specifically requests it. [Disk U-04]

SATELLIT

Last issue, Peter Wakelin reported a serious bug in the tracking program SATELLIT. I can confirm that the problem has been rectified in version 2.1, which also has a feature for switching off the checksum verification. This should allow 2-line element sets created by PROsatII to run in Satellit. Since the shareware version contains a device to deactivate it after several weeks' trial this is NOT offered in the library. Both shareware and registered versions are available from Karsten Hansky, August-Bebel-Str.14, 06712 Kretzschau, GERMANY. e-mail: hansky@igel.physik.th-zwickau.de. Registration costs DM20, +DM8 for shipping. The latest shareware version is always available via Internet by anonymous ftp to: igel.physik.th-zwickau.de

NEOPAINT v 3.2

Neopaint is the premier DOS graphics program and this version has added support for 32k and 64k colour modes (16 million colours has been supported since version 3.0). As far as I can ascertain, the bug that often corrupted colour images when saved in the TIFF format has been corrected, though the documentation makes no mention of the fact. But, best of all, following a licensing agreement with Unisys, the GIF format has been restored to Neopaint.

Neopaint has a number of uses for improving satellite images, most notable 'spotting' out odd errant pixels (which can be done under zoom for high accuracy), and sliding sections of image laterally should signal sync break down. Another use is the production of composite images. The Greenland image on page 85 of RIG 44 was created with Neopaint. [Disk I-05]

AOS v 3.00 and PREDICT v 2.00

These are new compiled versions of the BASIC programs I wrote a few years ago. AOS lists the a.o.s. time of the most favourable UK passes for all wxsats listed for a single day. PREDICT produces listings of the same a.o.s. times for up to 3 months for a selected satellite. Both programs can produce either screen or hard-copy but now run without the need to invoke QBASIC. If you need quick no-nonsense programs

to work out the best satellite a.o.s. times, these could be what you are looking for. [Disk T-07]

PAINTSHOP PRO 32-bit

Paintshop Pro is now available in 32-bit form for computers running Windows 95. Anyone requiring this version can obtain it by sending two 1.44 Mb discs. If there is a significant degree of interest in this version, I will add it to the Shareware Library from next Issue.

WST v 4.6g

Gordon Train's popular Weather Satellite Tracker program has been further upgraded, and the current version is a highly polished program. It is particularly useful to PROsatII users who lack the Track II utility as it automatically configures itself to run when the Track II option is selected from PROsat. [Disk T-07]

JUNE ADDITIONS TO THE RIG PC SHAREWARE CATALOGUE

The following reviewed shareware is offered on this quarter's compilation disk.

Disk RIG45:	PDSWIN, ORBITEL, SORTNENG, GEOCLOCK v 7.1, NEOPAINT v 3.2, AOS, PREDICT

SHAREWARE TITLE CATALOGUE

Programs requiring Microsoft Windows are indicated by an asterix (*)

Disk A-04	*Earth Centred Universe v 1.5, Lunar Eclipse, Skyglobe v 3.6, Skyview, Solar Eclipse Predictor, Solar System Finder
Disk A-05	*Skymap v 2.1 - Planetarium to display and print star charts etc.
Disk C-02	Hamcomm v 3.0, JVFAX v 7.0, Packet Monitor, RTTY_FAX, Satcom
Disk F-01	CUTNOAA, DATtoPA2, JOIN-PIX, NOATIFF, CHOP, REJOIN, PCPLOT
Disk I-05	IMDISP v 7.9e, JPEG v 5386, Neopaint V 3.2
Disk I-06	*Iphoto, *Lview Pro, *Photolab v 2.0

Disk I-07	*Photovision Pro v 1.1, PDSWIN v 2.0
Disk T-05	*Logsat v 3.0, *WinOrbit v 2.8, *Satspy v 1.0
Disk T-06	PC Track v 3.11, STS Orbit Plus v 9540, Trackstar v 2.15
Disk T-07	AOS, AOSUS, Bird Dog v 3.0, NOAATime, Predict, Sortneng, Spredict, Weather Satellite Tracker v 4.5k
Disk T-08	Traksat v 3.10, *Wpredict v 2.63
Disk U-04	Adjust Clock, BBC Time, PC Configuration v 7.33, Geoclock v 6.1, MSF, *RIG Index v 1.20, Screen Thief v 1.58, FAXCNV01
Disk V-01	Compushow v 2.04, GIFEXE v 4.5, QPV v 1.7A, SVGA v 1.12, VPIC v 6.2
Disk V-02	*GDS V 3.1g, PVE v 2.43, SEA v 1.0, *VUPRNT v 4.00.
Disk W-01	Weathr50, Windchill, WX-60, Weather Wizard
Disk PSP	*Paintshop Pro V 3.0
Disk GWS	*Graphic Workshop V 1.1T
Disk Belmont	*Belmont Image Technician (sophisticated image processing suite)

If you require more information about any of these shareware programs, please consult the program RIGSWCAT.EXE which appears on the majority of the shareware disks (space permitting). In addition to giving full details of each item, the program also features a search and find facility.

HOW TO OBTAIN COPIES OF THE RIG SHAREWARE LIBRARY DISKS

There is a despatch fee of £2 per order, which covers up to 6 disks (i.e. not £2 per disk). Send up to a maximum of 6 formatted 1.44 Mb MS-DOS 3.5" disks per request, to Les Hamilton, 8 Deeside Place, Aberdeen AB15 7PW, Scotland. Disks must be sent in a sturdy, re-sealable package such as a padded Jiffy bag (or a package within a package). Each separate request must be accompanied by:-

- i) a self-addressed adhesive label
- ii) stamps for the return postage
- iii) coins (or additional postage stamps) to the value of £2.

Note that overseas members' return postage is free, but an exchange of shareware or satellite images in lieu is always welcome.

Any RIG Member coming across any new or updated versions of useful shareware is encouraged to send them to me at the above address. Should you experience any problems running any of the shareware from the RIG Library, please enquire by letter, and I'll reply by return of post.

Queries regarding shareware can now reach me by e-mail: les@riglib.demon.co.uk. 🌐

RIG ON THE WORLD-WIDE WEB

John Boyer G0WRX

RIG has had a presence on the Internet for quite some time now. The original/existing pages were written by Michael Gill and have proved quite popular with several hundred accesses on the 'old site' each month. They show various aspects of RIG from a 'Beginners Guide' to some rather nice Okean/Sich images, just to whet ones appetite. There is also an online membership application form. However, as you are reading this you won't be needing an application form.

Politics have dictated that RIG has had to move off its inaugural site. We have now bought some space and have registered our own domain name. So the URL is now http://www.rig.co.uk/index.html. This is now set in tablets of stone so if we have to change to another service provider we should be able to take the URL with us. It would have been nice to have had a .org.uk style domain name, but apparently they are reserved for organisations such as registered charities.

Several changes are planned for the pages. Some of these are additional features that Michael was planning. For instance, there will be sample sound files so that those who haven't heard a particular satellite will know exactly what to listen for and a movie showing reception of an image.

I am desperately trying to learn Java which, for those of you who haven't come across it, is a means of producing programs that run inside Netscape to provide animations among other things. I hope sometime to try and add an online satellite prediction package to the web pages. If there is a RIG member out there willing to help then just email me at rig@rig.co.uk.

I would welcome suggestions for things people would like to see on the pages apart from more images. At present we are limited to 5MB of disk space but more can be bought if needed. 🌐

ORBITING UPDATE

ALL THE LATEST NEWS

POLAR ORBITING SATELLITES

NOAA 10 continues to give good HRPT channel 2 images and, being further west, the northbound late afternoon passes are better illuminated than those of NOAA 12. However, the APT transmitter remains off.

NOAA 12 is the operational morning southbound craft and is functioning well and, hopefully, will continue to do so until replaced by NOAA K later this year or early in 1997.

Apart from an unscheduled clock update when the on-board clock stopped on 30 April, NOAA 14 continues to operate normally as the northbound afternoon imager. Local time at the sub-satellite point on the Arctic Circle is 1230 so very good visible images of high-latitude places will be available for the next two or three months.

METEOR 2-21 took over from METEOR 3-5 on 14 May but its imagery is much inferior. The southbound passes of 3-5 will be well illuminated by late May so, hopefully, METEOR 3-5 will be returned to service soon.

OKEAN 4 (or 1-7), and SICH 1 continue to be the most interesting for many members. Although the weekly transmission schedules from Alex Ivanov (available by email from Rick Emerson's Wxsat list and from the RIG BBS) indicate which transmissions will be of stored recordings, they do not indicate the imaged area so there is often an element of surprise when the location is ascertained. Recently, several passes across the Arabian peninsula have been dumped over Europe from Sich 1.

From the transmission times of these two satellites, it is evident that Okean is controlled from Moscow and Sich from Yevpatoriya. Almost all the recorded images come from Sich 1 but about once a week there is a recorded image transmitted from Okean and it seems from the times of transmission of the 6-minute recordings that they are probably being picked up in Yevpatoriya and not Moscow. One of these recorded images from Okean is reproduced here. The imaging commenced at 1638 UT on 9 May when the spacecraft was southeast of Iceland, which shows clearly at lower right in the radar image, and continued for just over six minutes until well past Svalbard, the northern part of which shows near the top of the visible image at left. Image transmission was commanded at precisely 0101UT the following morning when Okean was high in the sky and almost abeam Moscow but not far above the horizon of Yevpatoriya.

GEOSTATIONARY SATELLITES

METEOSAT 5 is the prime mission satellite at 0 degrees longitude. The orbit's inclination is 0.4 degrees and increasing but with an estimated 7.4kg of hydrazine propellent remaining, it will be possible to maintain nominal orbit and attitude control until April 1997.

Due to contamination of Meteosat 5's cooler system, there was no regulation of the water-vapour or infrared channel detectors for about two weeks around the last winter solstice but, to date, there has been no noticeable degradation of the image quality. Nevertheless, a decontamination of the cooler and cold optics of Meteosat 5 is unavoidable. It will be planned for a time when Meteosat 6 can be can be used operationally as a full backup satellite.

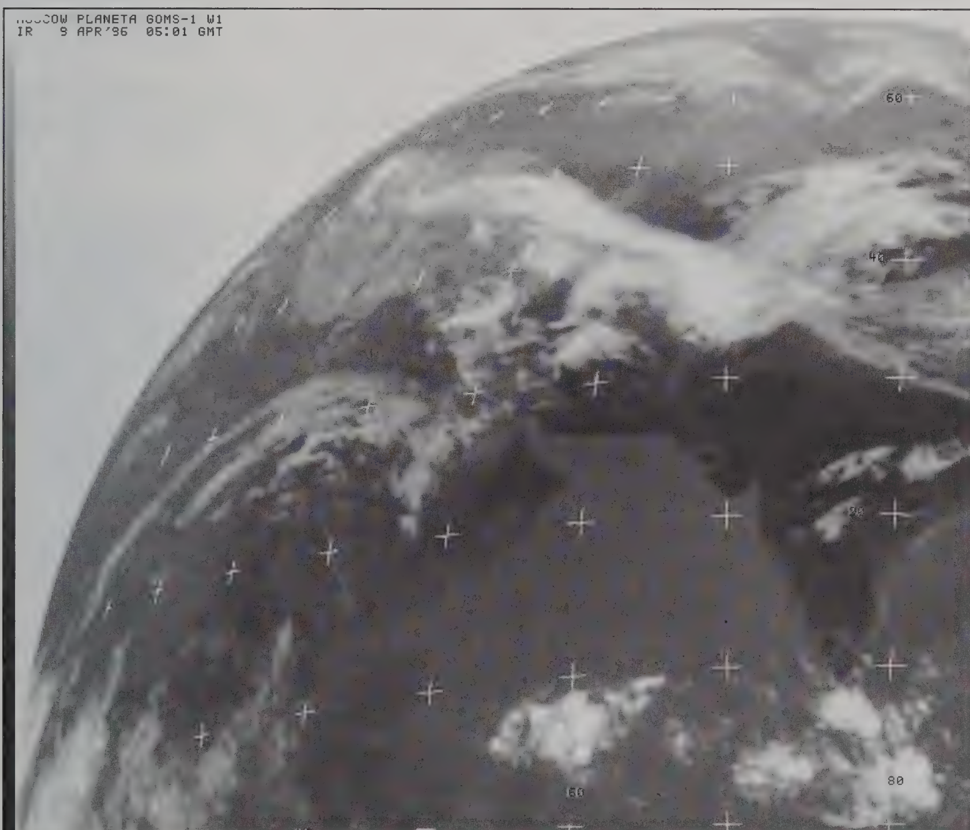
On 17 March the problem with the electronically de-spun antenna fixed itself, which means the disseminated signal is now stable again.

METEOSAT 6, situated near to 10W, remains the standby spacecraft. Its inclination is 0.229 degrees and decreasing and enough propellent remains for a further five years' nominal operations. In mid January the imaging mission for this satellite restarted in order to validate the image anomaly correction system. A satisfactory explanation of the radiometer's imaging anomaly remains elusive so there seems to be no alternative to applying the already developed software

Stored image from Okean 4

correction system to the raw image data. The major part of of the anomaly correction software has already been integrated into the EUMETSAT image processing system (IPS) in the operational core facility (OCF) in Darmstadt. During the first period of testing (for five weeks from 18 January) the anomaly was evident on a number of occasions. The gain variations experienced due to the anomaly were relatively moderate (of the order of 3 to 8%) and the variations in the IR and WV channels were in phase. Under these conditions the correction software worked well and produced corrected images of acceptable quality. However, when the water vapour anomaly is out of phase with the IR anomaly the current version of the correction software is unsatisfactory and further work is continuing.

METEOSAT 7 (or MTP 1) is the next of the current series with a launch due in July 1997.



GOMS 1 infrared image

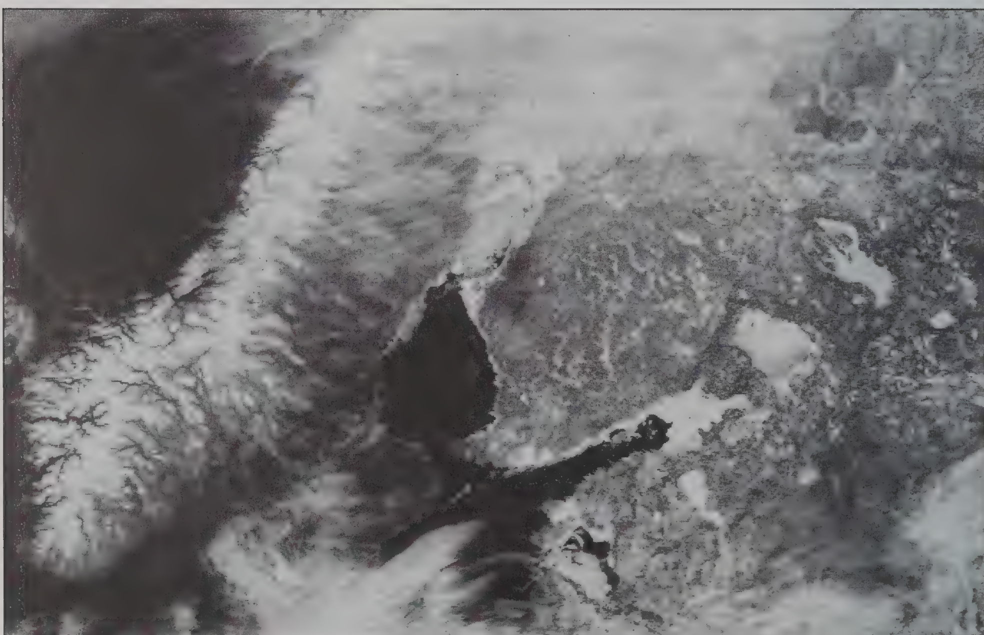
Plans to relay some GOMS WEFAX images via Meteosat are currently under discussion.

GOES 8 suffered a hardware fault on 18 April when the Random Access Memory of the number 1 Attitude and Orbit Control Electronics (AOCE) failed. Special complex operations were performed on 24 April to swap to the number 2 unit. The total data outage was only seven hours and full, normal operations were soon restored thus demonstrating the versatility of this highly complex new-generation craft.

GOES 9 operates normally at the GOES-West location (135W).

GOMS 1 would appear to be nearing some degree of operational readiness but I am unaware of any direct reception of imagery from it recently. The Russian Space Research Institute's Space Monitoring Information Support does make images received from RPA Planeta available on the Internet but, at the time of writing, the latest GOMS 1 images available are more than five weeks old.

Acknowledgements: I am grateful to the following for their contributions: Volker Gaertner, EUMETSAT; Jamie Hawkins and others at NOAA/NESDIS and RSSI, Moscow. ⊕



Winter persists in the Baltic region. Meteor 3-5, 12 April 1996. Les Hamilton

KEPLER ELEMENTS

```
NOAA 10
1  16969U 86073A   96134.93463919    .00000009                           6204
2  16969   98.5232  132.9854 0014312 092.0661  268.2156  14.24981827501720
NOAA 12
1  21263U 91032A   96134.95718472    .00000104                           9318
2  21263   98.5629  155.0461 0013668 018.7243  341.4433  14.22618059259596
NOAA 14
1  23455U 94089A   96134.83605204    .00000052                           6009
2  23455   98.9425  080.4210 0009859 346.3581  013.7329  14.11587092070600
METEOR 2-21
1  22782U 93055A   96134.83896973    .00000120                           4831
2  22782   82.5501  014.3671 0023754 077.0677  283.3280  13.83054991136381
METEOR 3-5
1  21655U 91056A   96132.66164334    .00000051                           8870
2  21655   82.5533  346.2655 0011924 264.8282  095.1463  13.16846992227869
METEOR 3-6
1  22969U 94003A   96133.88777556    .00000051                           2532
2  22969   82.5565  285.3988 0015686 330.8238  029.1998  13.16736734110402
OKEAN 4
1  23317U 94066A   96134.21099142    .00000149                           1527
2  23317   82.5421  091.2039 0024839 191.5662  168.4989  14.74016627085387
SICH 1
1  23657U 95046A   96131.44220896    .00000096                           0778
2  23657   82.5333  235.2927 0027452 168.7712  191.4118  14.73469935037276
```

Frequencies: NOAAs 14 137.62MHz, NOAAs 10/12 137.50MHz
METEORs 137.30, 137.40 or 137.85MHz
OKEAN 4, SICH 1 137.40MHz

Explanation of elements format above:

Line 1: NORAD catalogue number, International designation, Epoch, Decay rate (NDOT/2), Bulletin number (thousands omitted), Checksum (1 digit).

Line 2: NORAD catalogue number, Inclination, Right Ascension, Eccentricity (decimal point omitted), Argument of perigee, Mean Anomaly, Mean motion (8 decimal places), Rev. number, Checksum (1 digit). 🌐

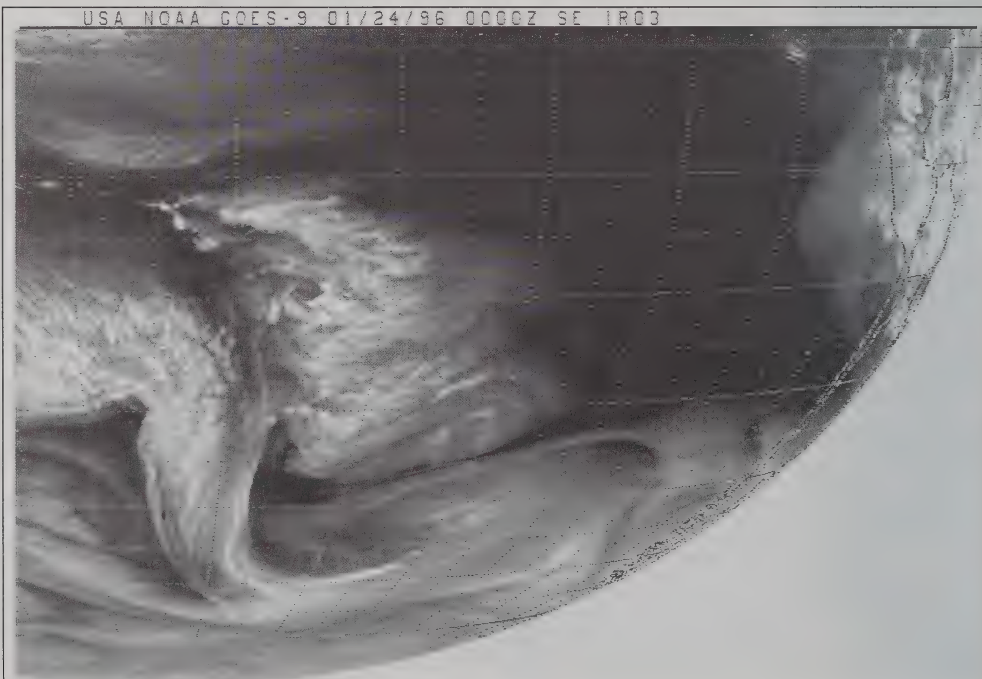
RIG GIF LIBRARY

PETER WAKELIN

I have added one more disk of images to the library. They come from Jim Whittaker who lives on the Queensland coast of Australia near Bundaberg. At that location, the Japanese GMS 5 geostationary satellite must be high in the sky but he is also just within range of GOES 9 which is above 135 degrees W and just above his NE horizon. This water-vapour channel image is one of three of his GOES 9 images on disk 148 and clearly shows the excellent quality. He also receives HRPT imagery and several of these are also on this disk. One of them shows a fine view of cyclone Barry in the Gulf of Carpentaria in January this year. The coloured image of New Zealand's South Island, which appears on the cover of this issue is one of his and is also on the disk.

The full list of available disks appeared in the March journal. The only addition is:

148 GOES 9/HRPT from Australia. 7 images from Jim Whittaker



GOES 9 Water vapour image of SE Pacific. 00UT 24 January 1996

HERE'S HOW TO OBTAIN DISKS

The cost is £2 for the first disk plus one pound for each additional disk with no limit to the number ordered. RIG provides disks, packaging and postage. For small orders, UK members may prefer to send postage stamps rather than write cheques for small amounts.

UK members: Cheque or postal order made payable to Remote Imaging Group and sent to Peter Wakelin, 1 Charters Road, ASCOT, Berkshire, SL5 9QF. There is no credit card service for members in the UK.

Other members: Bank draft (in Sterling and drawn on a London-based bank) or Eurocheque made payable to Remote Imaging Group and sent to Peter Wakelin at the address above. Overseas members may prefer to pay by credit card (subject to a 3% surcharge). Credit card orders should also be sent to Peter Wakelin either by post or fax (+44 1344 26028). ⊕

THE NEW RIG BBS

Mark Pepper

The new RIG BBS was commissioned on the 24th March and has worked flawlessly since. By the 30th April it had received 95 calls from 33 users, all as a result of number-spreading by word of mouth and a little advertising at the Chester conference. The system is designed to be both easy to access and easy to maintain providing easy access to the information judged crucial to RIG members and requiring minimal maintenance from its already busy system operators.

The system runs on a 486DX2-66 with 8Mbytes of RAM and 800Mbytes of hard disk space and runs Mustang's Wildcat V4 BBS software. Strictly speaking, this PC is over specified for a simple BBS, but to get a basic PC with a lower specification from a reputable dealer is difficult these days. We got this PC for just over £600 from Watford Electronics. The telephone end of things is managed by a US Robotics Courier V34 modem, a unit considered by those in the know to be one of the most reliable modems available and one used by many professional Internet providers in its rack-mounted form.

To keep system maintenance to a minimum several features found on the old BBS have been removed, namely, the mail and Sysop paging facilities. The system is designed to distribute RIG relevant information and to this end there are two primary services provided by the BBS. Firstly, the easy acquisition of vital Kepler elements is supported and secondly, the easy downloading of all the files in the

shareware library. Along with these two functions the BBS provides an up to the minute news service and a number of comprehensive Kepler element files.

The first thing that you will notice when logging onto the BBS is that before you get the chance to enter your name, the screen fills with Kepler elements. If you just want the elements then simply enable the capture option on your comms package before you dial; then, put the phone down as soon as you see the "name" prompt. Close your capture file and you will have a text file containing Kepler elements for all the currently active weather satellites. You will also have a very small (approximately 5 seconds) telephone bill, especially if your service provider supports per-second billing.

The captured file will have some junk at the beginning and end but this will be safely ignored by most prediction programs when the file is read in as a NASA two-line file. If not, load the file into a text editor such as DOS EDIT or Windows Notepad and delete all the junk and re-save the file.

If you want more, simply enter your name when prompted. If this is your first time on the new BBS then you will be asked a number of simple questions and then asked for a password of your choice. Next time you log in you will just need your name and password at which point you will enter the BBS for real.

Once in the BBS you will be met with a simple main menu from where you can read the latest news file, re-receive the elements file or go into the file menu.

In the files menu you can do a number of things but most importantly upload and download files. There are two file areas, Images and Utilities the contents of which speak for themselves. All uploaded files are only made available to the Sysop who will virus check the files before they are uploaded to the BBS for general consumption.

One last facility that should be available by the time this journal is published is an advertising service for RIG members. This follows the same rules and guidelines as for the readers' advertisements in the RIG Journal. Requests for advertisements should be sent to the editor as usual and will be placed in a members' advertisements area on the Bulletins menu. The item will be removed on request from the advertiser.

That's it, simple but effective. Should other facilities be required by RIG members they will be considered.

Here are some additional notes from Peter Wakelin who will perform the routine updating:

Elements files currently on the board are named KELSO.MET, KELSO.ALL and KELSO.AMS which are provided by Dr Tom Kelso. The first two are in NASA 2-line format and KELSO.ALL contains additional elements, including Mir and the Shuttle (when in orbit) whereas KELSO.AMS holds a few met satellites converted to the AMSAT multi-line format for those who really need them. I hope to eliminate this file in due course if the demand for it is minimal. Another elements file is called MOLCZAN.ZIP and contains Ted Molczan's file of around 2000 elements on all sorts of objects you never knew existed. It includes many classified US objects, whose elements are maintained by hobbyist amateur visual observers. So, if you want to watch the triple-payload 'flying triangles' cross the night sky then this is the file to get.

Alex Ivanov provides invaluable SICH and OKEAN transmission schedules which are available as ALEX.TXT. The newsfile can be read when on line or NEWS.TXT can be downloaded and read at leisure. The above files are currently updated early Tuesday evenings.

There is scope for further development and changes and any comments or requests for additional information to be included will be considered.

Please, please do not use the upload facility as an alternative to the post, fax and e-mail for general correspondence or for ordering goods from the RIG shop.

The BBS is located on the Ascot exchange which is not yet digital but accesses at 28,800 are feasible. The number is 01344 874140 or for calls originating outside of the UK it is +44 1344 874140. ⊕

RIG REGIONAL MEETINGS

The next Gatwick Group meeting will be held on 15 June, again at Copthorne. Being close to the airport, Chris van Lint has promised to 'drop in' from Hong Kong for this event. For details contact John Boyer on 01293 776862.

Members within a reasonable distance of Harwell, Oxfordshire will have received a note from Bill Woollen regarding the possibility of forming a local Group in that area. If you are interested but have not heard from Bill, then contact him on 01235 835253.

Nick Wilkinson has offered to act as coordinator to arrange a meeting of members in the Grays area of Essex in July. If you are interested then contact Nick on 01375 373718 during the evening. ⊕

RIG HELPLINES

General enquiries		John Tellick	0181 390 3315
Meteosat information, NOAA information, Complaints about RIG-supplied equipment.			

A copy of the Group's rules can also be obtained from John Tellick

Russian and Chinese satellite information		Peter Wakelin	01344 23200
HRPT		Peter Wakelin	01344 23200
PDUS		James Brown	01656 782632 *(not available on Sundays)*
Antennas and computing		John Boyer	01293 776862 *(7.00pm-9.00pm not Tuesdays or Wednesdays)*
Schools/educational co-ordinator		John Tellick	0181 390 3315
Schools/educational enquiries	John Murray	Torquay	01803 386252
	Frank Bell	Godalming	01483 416897
	Tom Walter	Reading	0118 9871330
	Bob Coombes	Haslemere	01428 642930
	John Din	Bristol	01454 773387
	Alan Wright	Norwich	01603 713449
	Rob Bales	Merseyside	0151 3439300

Microcomputer specialists:

PC and printer problems	Mark Pepper	01344 777730 *(8.00pm-9.00pm)*
Commodore Amiga	Chris Pretty	01420 82752
Archimedes	Tom Walter	0118 9871330

NOTE: We are grateful to the above members for offering their services to the Helpline. Please do not abuse the service by ringing them for queries other than those listed against their names.

Most of the helpline numbers listed under Schools/educational enquiries are situated in the south of England. John Tellick (address on page 2) would be pleased to hear from members in the educational field in other areas who would be willing to give help and advice.

REMOTE IMAGING GROUP

RIG SUBSCRIPTION - NEW MEMBER

If you would like to become a member and receive the Journal, photocopy this page, complete the form below, sign the declaration and send it to...

RIG SUB, PO BOX 142, Rickmansworth, Herts, WD3 4RQ, ENGLAND

The subscription rates for 1996 are...

UK membership	£10.00	Europe outside EC	£12.00
Europe EC	£12.00	Outside Europe	£14.00

Name ______________________________ Call Sign (if any)__________

Address. ____

____

__________________________________Post Code_______

Country _________________ Telephone No.______________________

Are you receiving:
Polar-orbiting Weather Satellites _____ Geostationary Weather Satellites _____

Do you require back issues? (see Rig Shop Corner) ______

Amount Enclosed £________

Payment by Visa/MasterCard/Eurocard - there is no surcharge:

Card No.________________________ Expiry date________

Signed _________________________________ Date ______________

Are you willing to have your name/address made known to members in your area? YES / NO. *(Delete as applicable)*

DECLARATION: I do NOT object to the Remote Imaging Group holding my Membership details on a computer.

Signed _________________________________ Date ______________

RIG SHOP CORNER

ALL PRODUCTS ARE FOR SALE TO RIG MEMBERS ONLY, FOR THEIR OWN PERSONAL USE AND NOT FOR SELLING-ON.
IN THE EVENT OF PROBLEMS WITH EQUIPMENT PURCHASED FROM RIG PLEASE CONTACT RIG IN THE FIRST INSTANCE AND NOT THE MANUFACTURER.

All prices shown include post and packing except where marked

Receiving / Decoding Equipment	**UK/EC Price**	**Overseas Price**
RIG*sat*-RX1 two-channel 137MHz self-build receiver.		
PCB, crystal IF filter and FETs	No longer available	
PCB and FETs only	No longer available	
RIG *sat*-RX1A 5-channel upgrade PCB	£4.00	£4.00
RIG *sat*-IF1	£4.50	£5.00
RIG DARTCOM Meteosat Downconverter. Assembled and tested module in tin plate box	£155.00	£132.00
Complete, assembled and mounted in weather-proof box.	£190.00	£162.00
RIG DARTCOM VHF Scanning Receiver. Assembled and tested module with LED channel number display.	£135.00	£115.00
As above but with LCD frequency read-out instead of LED channel number display. *Both the above items are modules and require a box, together with several components, switches, etc.*	£179.00	£152.00
RIG VHF Preamp. Includes a bandpass filter and is ideal for mast-head mounting. Assembled/tested module; needs boxing.	£18.00	£16.00
RIG 1695MHz Low Noise Amplifier kit. *Experienced constructors only.*	£29.00	£25.00
Martelec JVFAX Interface Unit	£78.00	£70.00
Connecting lead £5 extra (specify whether 25 or 9-pin required)		

Antenna systems

	UK Price
RIG CROSSED DIPOLES A Turnstile type design, in kit form	£26.00
RIG/TH2 47-element YCV loop Yagi (1.7GHz)	£85.00
JAYBEAM 5X-Y 2m 5 element crossed Yagi, in kit form	£55.00

DISHES, FEEDS and BACKING PLATES not available by mail order. Contact Henry Neale. Tel:01945 440353

Crossed dipoles and the YCV loop Yagi can be dispatched overseas. Postage extra. Details on request from Peter Wakelin.

RIG Binders

UK Price £4.00 each, EC/European Price £4.50, Outside Europe Price £5.00.

CD-ROMS	UK Price	EC Price	Other Price
Meteosat No. 2, Weather in Motion	£12.50	£13.50	£15.00
Meteosat No. 3, Europe's Four Seasons (2 disks)	£12.50	£13.50	£15.00

Back Issues of RIG Journals

		UK Price	**EC/Europe Price**	**Outside Europe Price**
RIG 8-11	1987	£5.00	£6.00	£7.00
RIG 12-15	1988	£5.00	£6.00	£7.00
RIG 16-19	1989	£5.00	£6.00	£7.00
RIG 20-23	1990	£6.00	£7.00	£8.00
RIG 24-27	1991	£6.00	£7.00	£8.00
RIG 28-31	1992	£6.00	£7.00	£8.00
RIG 32-35	1993	£6.00	£7.00	£8.00
RIG 36-39	1994	£6.00	£7.00	£8.00
RIG 40-43	1995	£6.00	£7.00	£8.00

Note: Prices quoted are for a set of four, including Post and Packing.

RIG 1-7 are currently out of print. Owing to depletion of some issues, photocopies may be supplied. Individual issues are no longer available (hardship cases excepted).

Ordering Information

All items are available from the Editor, Peter Wakelin (address on page 2) and include return by UK 1st class mail (except antennas and Journals). Items to non-UK addresses sent via airmail.

UK VAT is now applicable on sales to the following EC countries - France, Germany, Belgium, Portugal, Spain, Republic of Ireland, Austria, Sweden, Denmark, Italy, Luxembourg, Netherlands, United Kingdom (including Isle of Man). Members in these countries should use UK/EC price when ordering. EC members who are registered for VAT must forward their VAT registration No. to the Treasurer to enable them to receive VAT exempt goods.

As UK/EC prices now include VAT where applicable; receipts will be issued upon request. Remote Imaging Group VAT Registration No. 594 7483 83. Channel Isles: divide by 1.175 to remove VAT content.

UK members, By Cheque or Postal Order.

Overseas members, Pay by Bank Draft (drawn on a UK London-based bank) or Eurocheque(s). (Payments to a Maximum of £100.00 in any one Eurocheque). No local currency please.

All cheques made payable to "REMOTE IMAGING GROUP".

Credit Cards Accepted (Access/Visa/Mastercard/Eurocard) Add 3% to Total. Available by MAIL ORDER from Peter Wakelin (address on page 2) or FAX 01344 26028 (International +44 1344 26028).

Please state type of card, Card No., Expiry Date.
All Credit Cards authorised before goods are despatched.
(Note: Ordering by Credit Card does not mean instant despatch!)

RIG AT RALLIES

RIG will be at the following Rallies:

Longleat	30 June
BARTG, Sandown	15 September
Leicester	18,19 October

SUBMISSION OF ITEMS FOR PUBLICATION AND COPY DEADLINES

Please send contributions, which should be original, to the Editor. Although typed and hand-written items are quite acceptable we would prefer longer pieces to be on a PC disk in one of the popular word-processing formats, ideally in Word Perfect. Drawings and diagrams may be submitted on disk, preferably in a Windows Meta File compatible format, but please send hard copy also. Diagrams and images must be in separate files and should not be embedded in documents. To reproduce well, satellite images must have a good range of tones. Contact the Editor for further information.

COPY DEADLINE FOR THE SEPTEMBER ISSUE: 25 JULY 1996

RIG ON LINE

Bulletin board: Tel 01344 874140

World Wide Web: http://www.rig.co.uk/index.html

Packet: G4TRE@GB7EIP - "WXSAT@GBR"

The BBS contains recent orbital elements, news likely to be of interest to members, the current satellite transmitting status, relevant software, some images and also members' 'For Sale' and 'Wanted' notices.

The WWW pages, which are still under development, contain images, status reports and information about remote sensing and RIG.

OTHER BULLETIN BOARDS

Henry Neale BBS:	Tel 01945 440666
Timestep BBS:	Tel 01440 820002
Dartcom BBS:	Tel 01822 880249

All the above bulletin boards use 8 bit, no parity, 1 stop bit. ⊕

LATE NEWS:
THE MILLENNIUM SATELLITE - Addendum

Subject to availability prior to mailing this journal, a loose insert will be included which describes this project. Although aimed at schools, the contents are also applicable to amateur interests. ⊕

DESCRIPTION OF COVER IMAGES

Front Cover:

This pair of images well illustrates how land temperatures fluctuate dramatically between night and day compared with the almost constant sea temperature. The left image, taken by the ERS 1 satellite's 11 micrometre thermal infrared imager, shows the eastern Mediterranean region including the island of Cyprus close to noon. The right hand image shows the same area about 12 hours later. Colours do not equate to the same temperatures in both images but in each case yellows and reds are colder than greens and blues. In the daytime, the land is hotter than the sea, whereas at night the reverse is true. These images are from John Boyer and were processed by Rutherford Appleton Laboratory.

Inside Front Cover:

Top: This NOAA 11 image of northwest Europe dated 26 April 1991 was received and processed by Mike Goodall.
Bottom: A similar area to the image above but viewed from above the equator by a Meteosat. This primary data image was received and processed by James Brown.

Inside Back Cover:

Top: Australian member Jim Whittaker sent this colourful NOAA HRPT image of part of New Zealand's South Island.
Bottom: Nobuhiro Kajikawa successfully constructed this helical feed for his HRPT system using the design described by JC Beneche in RIG 40.

Back Cover:

Top: In the last issue (page 54) we showed you the effect and now we can show you the cause. This photograph shows the volcanic peak in the northeast of Jan Mayen Island through a brief break in the low cloud. The 2,277m (7,417ft) peak can create remarkable patterns of waves and vortices for hundreds of kilometres downwind when weather conditions are suitable. We are grateful to Dennis West for this photograph which was taken from a cruise ship en route from Iceland to Spitzbergen on 25 June 1995.
Bottom: Mark Pepper, Mark Clarke and Sam Elsdon on the RIG stand at the Chester conference on 27 April. ⊕

Okean 4 image of the Baltic region in two wavelengths; 3cm radar at left and 8mm radar at right. 1348UT 19 May 1996. Peter Wakelin.

NOAA 14 image from Chris van Lint showing the Irrawaddy delta, Thailand and the Andaman Islands.

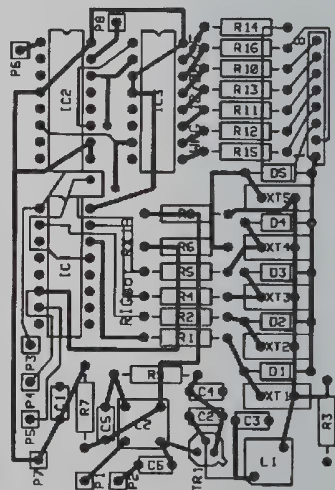
Greenland and Iceland. Jan Mayen Island at top right edge. Meteor 3-4, 17 April 1992. Gordon Train.

RIG*sat* RX1A

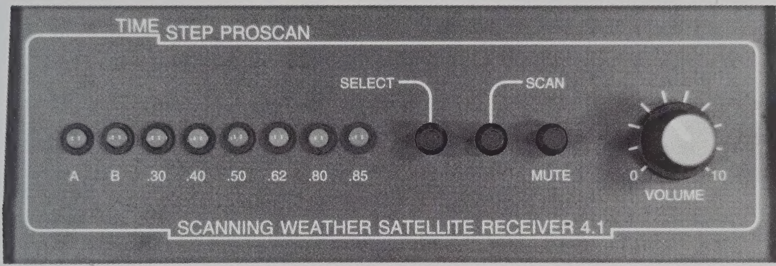
5-channel upgrade for the RX1. Small, convenient add-on with numeric display. Can be configured for 3, 4 or 5 channels.

Supplied as printed circuit board 8cm x 5cm with plated through holes and silk-screened component layout. Full instructions are included together with parts ordering information.

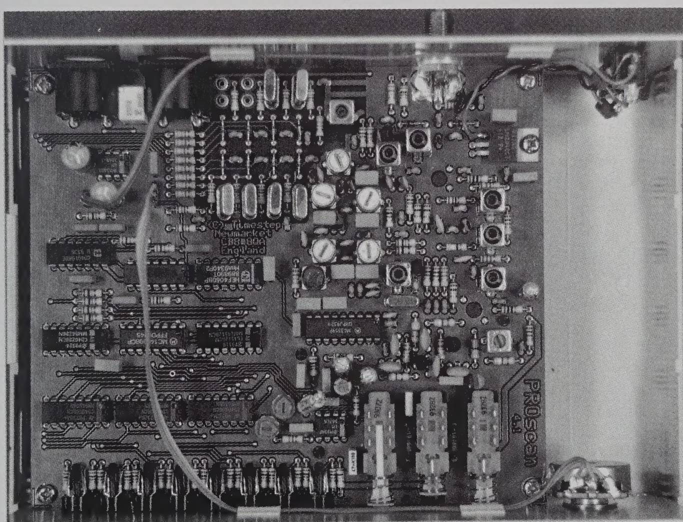
Prices including post & packing: UK £4. Overseas £4.50. See Shop Corner for ordering procedure.



Timestep Offer to RIG Members
PROscan Polar Receiver



What do you want from a Scanning Weather Satellite Receiver ? a) Intelligent squelch that only responds to weather satellites and is quiet when no satellite is present b) To be able to read the frequency directly from the front panel when it stops on a satellite c) To be able to "lock out" unwanted satellites d) Resistant to pager interference up to the pager transmitter itself (where of course the field strength is low e) Resistant to pager interference at 1 to 2 miles where the field strength is at a maximum f) An unconditional 12 month money back guarantee g) Full technical support directly from Timestep **and** h) the ability to control the receiver frequency from the computer so that you are sure that **all** passes can be received in your absence.



The PROscan receiver uses a lot of filtering, 3 coils in the pre-amp (optional), 4 coils in the RF amp (total 7 coils at RF), 3 coils in the oscillator, 1 matching coil at first IF, 5 ceramic filters at first IF, 5 coils at second IF (total 11 IF filters) and a quadrature discriminator for linearity and high ultimate signal to noise. A preamplifier is not required for short cable runs but adds extra selectivity and makes up for feeder loss on longer runs.

Timestep PO Box 2001 Newmarket CB8 8XB England
Tel. 01440 820040 Fax. 01440 820281

Trade Talk

** Summer news to **RIG Members** from Timestep **

Chester saw over 100 enthusiastic RIG members glued to their seats when Martin Harris gave a illustrated talk about his trip to Northern Russia using PROsat II software. Significant anomalies in the weather and global warming were detected using the PROsat II direct temperature readout. An unsolicited plug and a good reason to buy such an advanced software and hardware solution !
Dave Cawley demonstrated LIVE HRPT using a computer controlled dish. The dish was set up in the car park and gave a stunning image where thermal heat islands clearly showed most cloud free towns and cities. HRPT prices have been reduced to help RIG members that are saving up.

PROsat for Windows Roger Ray was so excited with the increased resolution that he sent a complete description to Short Wave Magazine. Brian Dudman has ordered a second one, well he always had only the best ! The resolution, automatic colour, Meteosat and NOAA temperature calibration and the multi-tasking abilities are just so good. Animate the Whole World AND Europe AND get every frame in colour in 3 (or more) separate windows, zoom in for stunning detail and resolution.

PDUS Now that Meteosat 5 has fixed its antennas, we are once again getting noise free images on a 1.6M dish. A new analogue PLL is fitted to the new PDUS card and gives another small improvement. The new card also allows the new HRPT card to be used in the same computer.

HRPT Chris van Lint reports reception down to just 0.5 degree above the horizon from his flat in Hong Kong. Internet reports that the Timestep HRPT system is used by numerous customers with exceptional results.

RIG Prices Timestep offer RIG members very preferential pricing. The price exists for the duration of the magazine, therefore pricing quoted in Issue Number 44 has now expired and the pricing in this issue will expire when RIG 46 is printed. If you are asking us for prices, you must identify yourself as a RIG member. If you do not mention RIG every time you will be quoted the standard list price.
All prices to RIG members are cash with order (no credit), we cannot supply items to anyone other than yourself. The prices are for cheques payable at a London Bank, MasterCard, Visa, Switch and bank transfer. We cannot accept Euro Cheques or official orders at these prices. Quotations are not needed, the prices below are correct. Remember PROsat II has now gone down in price (we pay your VAT !)

BBS Our BBS can be accessed by anyone with a modem. You do not need to be on Internet or have any complications. Plug the modem into your computer and that's it. No subscriptions no fees and no hassle. It is mostly updated every week and never more that 14 days old. Elements and news files and satellite status reports are easily down-loaded so that you can update your software and print out the news to read at your leisure. We can handle virtually any standard right up to 28,800. The number to call is 01440 820002.

RIG Members prices

PROscan receiver £225.00
PROsat II card/software £99.00
Assembled crossed dipole antenna £45.00
PROsat for Windows card/software £249.00
HRPT dish/feed £190.00
Autotrack computer/dish controller £190.00
P-HEMT Preamplifier (only with RX) £120.00
HRPT PC analogue card and software £250.00
VHF 137MHz preamplifier £25.00
PROsat/PROscan connecting cable £15.00
40M antenna cable £30.00
PROsat windows PROscan connecting cable £29.50
Yeasu R5400 Az-El rotator £525.00
20M rotator cables (must be ordered with the rotator) £95.00
6 channel HRPT receiver £550.00
20M signal cable £18.00

VAT included, carriage in the UK £6.00 per order, elsewhere £35.00 by Fed Ex/UPS.

Timestep PO Box 2001 Newmarket CB8 8XB
Tel. 01440 820040 Fax. 01440 820281



THE METEOSAT SATELLITE
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